





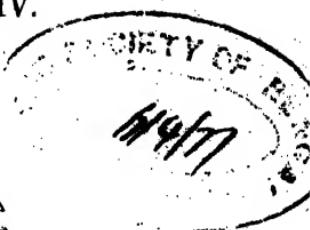






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# A MONOGRAPH

OF THE

## BRITISH SPONGIADÆ.

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*This Volume is Inscribed,*

WITH GREAT RESPECT, TO THE MEMORY OF THE LATE

**DR. GEORGE JOHNSTON,**

**OF BERWICK-ON-TWEED,**

AN ENTHUSIASTIC AND TALENTED OBSERVER AND WRITER ON

**NATURAL HISTORY;**

WHOSE NUMEROUS WORKS ON BOTANY AND MARINE ZOOLOGY, AND ESPECIALLY

ON THE SPONGES AND ZOOPHYTES OF GREAT BRITAIN,

HAVE POWERFULLY AIDED IN THE DIFFUSION OF A TASTE FOR

THE CULTIVATION OF THOSE SCIENCES.



## P R E F A C E.

IN the first volume of this work, page 159, in the 'Tabular View of Systematic Arrangement,' I included the exotic as well as the native genera; believing it highly probable that some of the species of the former would before long be found among our British Sponges; and this idea has been already realised, by my having since that period added two species of *Ecionémia* and one of *Ophlitaspongia*, an entirely new genus, to our list of British species. I have followed the same course in the synopsis of the genera in this volume, but to prevent any misconception regarding the British Genera, I have given a list of those which are described in this volume, with the number of species in each, in the Table preceding the synopsis of the Genera.

Generally speaking, there is no great difficulty in the determination of the genus, but in some cases more than ordinary caution is necessary in the examination of the specimen under consideration. The greatest difficulty in this respect lies in the determination of specimens belonging to the first section of *Halichondria*, and the first of *Isodictya*. In the former, the structures are so loosely and irregularly reticulated, as to render it very difficult to distinguish between them, and some specimens of the latter,

without the section for examination be very carefully made from a specimen in a good state of preservation, and correctly at right angles to the surface ; but in all cases of the examination of a specimen, the last observation should be especially impressed on the memory.

In the synopsis of the Genera I have endeavoured to give the student every facility for references to the letter-press and plates of the first volume of this work, and this is the more necessary, as the terminology adopted in the generic and specific descriptions is to a great extent new to this branch of Natural History. This facility of reference will, I trust, aid the student materially in his examinations of both genera and species that may be new to him.

Notwithstanding my long and intimate acquaintance with the species of British Sponges, such is their extreme variations in colour, size, and form, especially in the dried state, that it has frequently occurred that I have failed to recognise specimens of some of the commonest species, until I have submitted them to a regular microscopical examination ; and indeed there are some that so closely resemble each other, in all their external characters and habits, as to render such an examination absolutely necessary to the correct determination of the species. I have therefore deemed it necessary, not only to render the genera as distinctly recognisable as possible, but also when the number of species in a genus are numerous, to again divide and subdivide them by means of the peculiarities of the spicula of the skeleton, so as to facilitate the labour of the determination of the species within the smallest possible range, for the convenience of the student. To effect this purpose, I have divided, when necessary, each genus into

sections, determinable by the forms of the spicula; and each of these sections are again divisible, into those which have the spicula smooth, and those which are furnished with spines. I have considered the sections and sub-sections into which the genera are thus divided as permanent divisions, applicable to all the genera alike; the sections being distinguished by one, two, three, or more asterisks, and the sub-sections are indicated by letters. The species in some of these divisions and subdivisions are already very numerous, as at the present time we have in the genus *Hymeniacidon* 42, in *Halichondria* 28, and in *Isodictya* 43 species; and I believe these divisions and subdivisions to be the more necessary, as from the quantity of new species I have lately received, there is every appearance that the number of British Sponges will be greatly multiplied by the researches of naturalists before many years shall have elapsed.

I have not adopted the extensive list of synonyms of the British species given by Dr. Johnston, as I have good reason to believe that many of them are unavoidably very doubtful; I must therefore beg to refer the reader, who may wish to enter upon an investigation of that portion of their history, to that learned author's 'History of the British Sponges,' &c. Thus the references to habitats of *Hymeniacidon fucus*, *carnosa*, and *subcreta*, are rendered very uncertain, from the habit each has of simulating the forms assumed by the other two, and also from species having hitherto been established from external form only, while each individual varies exceedingly in that character at different periods of its development, and in accordance with the necessities induced by the peculiarities of its locality. The wide diffusion of the species renders it un-

necessary to publish each separate habitat; I have, therefore, in a great measure, confined the list to those which are within my own personal knowledge, and that of my friends who have kindly supplied me with specimens for examination, except in a very few cases.

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A LIST OF BRITISH GENERA OF SPONGES, WITH  
THE NUMBER OF SPECIES IN EACH.

*Order 1.—CALCAREA.*

Grantia . . . . .	4
Leucosolenia . . . . .	4
Leuconia . . . . .	3
Leucogypsa . . . . .	1

*Order 2.—SILICEA.*

Geodia . . . . .	Sub-Order 1 . . . . .	1
Pachymatisma . . . . .	" . . . . .	1
Ecionemia . . . . .	" . . . . .	2
Polymastia . . . . .	" . . . . .	7
Halyphysema . . . . .	" . . . . .	2
Ciocalypta . . . . .	" . . . . .	1
Tethea . . . . .	" . . . . .	5
Halicnemia . . . . .	" . . . . .	1
Dictyocylindrus . . . . .	" . . . . .	11
Phakellia . . . . .	" . . . . .	2
Microciona . . . . .	" . . . . .	8
Hymeraphia . . . . .	" . . . . .	4
Hymedesmia . . . . .	" . . . . .	3
Hymeniacidon . . . . .	Sub-Order 2 . . . . .	42
Halichondria . . . . .	Sub-Order 3 . . . . .	28
Isodictya . . . . .	" . . . . .	43
Spongilla . . . . .	" . . . . .	2
Desmacidon . . . . .	Sub-Order 4 . . . . .	5
Raphyrus . . . . .	" . . . . .	1
Diplodemia . . . . .	Sub-Order 5 . . . . .	1

*Order 3.—KERATOSA.*

Spongionella . . . . .	Sub-Order 1 . . . . .	1
Chalina . . . . .	Sub-Order 3 . . . . .	7
Ophlitaspongia . . . . .	" . . . . .	1
Verongia . . . . .	Sub-Order 4 . . . . .	1
Dysidea . . . . .	Sub-Order 7 . . . . .	1

A MONOGRAPH  
OF THE  
BRITISH SPONGIADÆ.

SYNOPSIS OF GENERA.

CLASS—PORIFERA, *Grant.*

ORDER I.—CALCAREA.

- Genera.* 1. GRANTIA.  
2. LEUCOSOLENIA.  
3. LEUCONIA.  
4. LEUCOGYRSIA.

1. GRANTIA, *Fleming.*

Sponge. Furnished with a central cloaca, parietes constructed of interstitial cells, more or less regular and angular in form, disposed at right angles to the external surface, and extending in length from the outer to very near the inner surface of the sponge, where each terminates in a single osculum. Vol. I, p. 162.

Type, *Grantia compressa*, Johnston. Vol. I, Plate XXI,  
Figs. 312, 313, and Plate XXVI, Figs. 345,  
346, *a*, *b*.

## 2. LEUCOSOLENIA, Bowerbank.

*GRANTIA*, Fleming and Johnston.

Sponge. Fistular. Formed of a single layer of triradiate and other spicula, surrounding a large central cloaca, which extends into all parts of the sponge. Vol. I, p. 164.

Type, *Grantia botryoides*, Fleming. Vol. I, Plate XXVI,  
Figs. 347, 348.

## 3. LEUCONIA, Grant.

*GRANTIA*, Fleming and Johnston.

Sponge. Furnished with cloacæ, one or more. Parietes of sponge formed of a mass of irregularly disposed interstitial membranes, and triradiate and other spicula; permeated by sinuous excurrent canals, the oscula of which are irregularly disposed over the surfaces of the cloacæ. Vol. I, p. 164.

Type, *Grantia nivea*, Fleming. Vol. I, Plate XXVII,  
Figs. 351, 352.

## 4. LEUCOGYPSIA, Bowerbank.

Sponge. Massive, without cloacæ; formed of irregularly disposed membranous tissues and spicula. Oscula at the external surface. Vol. I, p. 165.

Type, *Leucogypsia Gossei*, Bowerbank. Vol. I, Plate XXVI,  
Figs. 349, 350.

## ORDER II.—SILICEA.

Suborder I. Spiculo-radiate skeletons. Not reticulate.

Composed of spicula radiating in fasciculi or separately from the base or axis of the sponge.

- |   |                                     |
|---|-------------------------------------|
| 1. <i>Geodia</i> , Lamarck.               | 9. <i>Halicnemia</i> , Bower-       |
| 2. <i>Pachymatisma</i> , Bower-           | bank.                               |
| 3. <i>Ecionemia</i> , Bowerbank.          | 10. <i>Dictyocylindrus</i> , Bower- |
| 4. <i>Alcyoncellum</i> , Quoy et Gaimard. | bank.                               |
| 5. <i>Polymastia</i> , Bowerbank.         | 11. <i>Phakellia</i> , Bowerbank.   |
| 6. <i>Halyphysema</i> , Bower-            | 12. <i>Microciona</i> , Bowerbank.  |
| 7. <i>Ciocalypta</i> , Bowerbank.         | 13. <i>Hymeraphia</i> , Bower-      |
| 8. <i>Tethea</i> , Lamarck.               | bank.                               |
|   | 14. <i>Hymedesmia</i> , Bower-      |
|   | bank.                               |

### 1. GEODIA, Lamarck.

Skeleton. Spicula fasciculated, radiating from the base or central axis of the sponge to the surface. Dermis crustular, furnished abundantly with closely packed ovaria. Ovaria siliceous, composed of cuneiform spicula, firmly cemented together by silex, in lines radiating from the centre of the ovary. Pores furnished with œsophageal tubes, terminating in the distal extremity of the intermarginal cavities. Intermarginal cavities separate, symmetrical, subcylindrical; each furnished with a membranous valve at its proximal extremity. Vol. I, p. 167.

Type, *Geodia Barretti*, Bowerbank, MS.—Vol. I, Plate XXVIII, Fig. 354, and Plate XIX, Figs. 301, 302.

### 2. PACHYMATISMA, Bowerbank.

Skeleton composed near the external surface occasionally of

short fasciculi of siliceous spicula, disposed in lines at about right angles to the surface of the sponge. Central portion of the sponge unsymmetrical. Dermis crustular, furnished abundantly with closely packed ovaria. Ovaria siliceous, formed of cuneiform spicula, firmly cemented together in lines radiating from the centre of the ovary. Pores furnished with cesophageal tubes, terminating in the distal extremity of each intermarginal cavity. Intermarginal cavities symmetrical, subcylindrical, with a pyloric valve at the proximal end of each. Vol. I, p. 171.

Type, *Pachymatisma Johnstonia*, Bowerbank. Vol. I, Plate XXVII, Fig. 353.

### 3. ECIONEMIA, BOWERBANK.

Sponge. Having a strong axial column or centre of closely packed siliceous spicula disposed in lines parallel to the long axis of the sponge, from which axial column or centre a peripheral system of spicula radiates at about right angles. Distal ends of the radii furnished more or less with ternate connecting spicula, the radii of which are disposed immediately beneath the dermal membrane. Vol. I, p. 173.

Type, *Echionemia acervus*, Bowerbank, MS. Vol. I, Plate XXVIII, Fig. 355.

### 4. ALCYONCELLUM, QUOY ET GAIMARD.

#### EUPLECTELLA, OWEN.

Sponge fistulate; fistula single, elongate, without a massive base. Skeleton: primary fasciculi radiating from the base in parallel straight or slightly spiral lines; secondary fasciculi at right angles to the primary ones. Oscula congregated, with or without a marginal boundary to their area. Vol. I, p. 174.

Type, *Alcyoncellum*, Quoy et Gaimard. Figures from *Euplectella aspergillum*, Owen. Vol. I, Plate XXIX, Figs. 356, 357.

### 5. POLYMASTIA, Bowerbank.

Skeleton. Basal mass. Central portion consisting of a plexus of contorted anastomosing fasciculi, resolving themselves near the surface into short straight bundles disposed at nearly right angles to the surface. Oscula congregated, elevated on numerous long fistulæ. Fistulæ composed of numerous parallel fasciculi, radiating from the base to the apex of each in straight or slightly spiral lines. Vol. I, p. 177.

Type, *Polymastia mammillaris*, Bowerbank. Vol. I, Plate XXIX, Fig. 358.

### 6. HALYPHYSHEMA, Bowerbank.

Sponge. Consisting of a hollow basal mass, from which emanates a single cloacal fistula. Skeleton: spicula of the base disposed irregularly; spicula of the fistula disposed principally in lines parallel to the long axis of the sponge without fasciculation. Vol. I, p. 179.

Type, *Halyphysema Tumanowiczii*, Bowerbank. Vol. I, Plate XXX, Fig. 359.

### 7. CIOCALYPTA, Bowerbank.

Skeleton. Composed of numerous closed columns, each consisting of a central axis of compact, irregularly elongated, reticulated stricture, from the surface of which radiate, at about right angles, numerous short, simple, cylindrical pedicels, or stout fasciculi of closely

packed spicula; the distal ends of each pedicel separating and radiating in numerous curved lines, which spread over the inner surface of the dermal membrane, separating and sustaining it at all parts at a considerable distance from the central axis of the skeleton. Vol. I, p. 179.

Type, *Ciocalypta penicillatus*, Bowerbank. Vol. I, Plate XXX, Figs. 360, 361.

#### 8. TETHEA, Lamarck.

Sponge massive, suborbicular. Skeleton consisting of fasciculi of spicula. Fasciculi radiating from a basal or excentrical point to the surface. Intermarginal cavities unsymmetrical, confluent. Propagation by internal or external gemmulation. Vol. I, p. 181.

Types, *Tethea lyncurium*, Linnæus, and *T. cranium*, Lamarck. Vol. I, Plate XXXI, Fig. 362.

#### 9. HALICNEMIA, Bowerbank.

Skeleton formed of a single superior stratum of spicula radiating from the centre to the circumference of the sponge at about its middle; and of an inferior stratum of spicula distributed without order. Vol. I, p. 184.

Type, *Halicnemia patera*, Bowerbank. Plate XXXII, Figs. 363, 364.

#### 10. DICTYOCYLINDRUS, Bowerbank.

Skeleton. Without fibre. Composed of a loosely compacted columnar axis of spicula, disposed principally in the direction of the line of the axial column, from which a peripheral system of long single or fasciculated

BRITISH SPONGIADÆ.

defensive spicula radiate at right angles to the axial column. Vol. I, p. 185.

Type, *Dictyocylindrus hispidus*, Bowerbank. Vol. I, Plate XXXII, Fig. 365, and Plate XXXIII, Fig. 366.

11. PHAKELLIA, *Bowerbank*.

Skeleton. Composed of a multitude of primary cylindrical axes, radiating from a common base and ramifying continuously, from which emanate at about right angles to the axes a secondary series of ramuli, which ramify continuously as they progress towards the surface, but never appear to anastomose. Vol. I, p. 186.

Type, *Phakellia ventilabrum*, Bowerbank. Vol. I, Plate XXXIII, Fig. 367.

12. MICROCIONA, *Bowerbank*.

Skeleton. A common basal membrane, whence spring at or about right angles to its plane numerous separate columns of spicula intermixed with keratode, furnished externally with spicula which radiate from the columns at various angles towards the dermal surface of the sponge. Vol. I, p. 188.

Type, *Microciona atrasanguinea*, Bowerbank. Vol. I, Plate XXXIII, Fig. 368, and Plate XXXIV, Fig. 369.

13. HYMERAPHIA, *Bowerbank*.

Skeleton. A single basal membrane, whence spring numerous large separate spicula, which pass through the entire thickness of the sarcodous stratum to or beyond the dermal surface of the sponge. Vol. I, p. 189.

Type, *Hymeraphia stellifera*, Bowerbank. Vol. I, Plate XXXIV, Fig. 370.

#### 14. HYMEDESMIA, Bowerbank.

**Skeleton.** A common basal membrane sustaining a thin stratum of disjoined fasciculi of spicula. Vol. I, p. 190.

Type, *Hymedesmia Zetlandica*, Bowerbank. Vol. I, Plate XXXV, Fig. 371, and Plate XVIII, Fig. 296.

**Suborder II.** Spiculo-membranous skeletons. Composed of interstitial membranes, having the skeleton spicula irregularly dispersed on their surfaces.

The prominent character of this Order is that the spicula of the sponges composing it do not assume either the radiate, fasciculate, or reticulate structural arrangement. The distribution of the spicula on the interstitial membranes being without any approximation to order.

#### HYMENIACIDON, Bowerbank.

**Skeleton** without fibre, spicula without order, imbedded in irregularly disposed membranous structure. Vol. I, p. 191.

Type, *Hymeniacidon caruncula*, Bowerbank. Vol. I, Plate XXXV, Fig. 372.

**Suborder III.** Spiculō-reticulate skeletons. Skeletons continuously reticulate in structure, but not fibrous.

1. *Halichondria*.
2. *Hyalonema*.
3. *Isodictya*.
4. *Spongilla*.

BRITISH SPONGIADÆ.

1. HALICHONDRIA, *Fleming*.

Sponge. Skeleton without fibre; composed of an irregular polyserial network of spicula cemented together by keratode. Vol. I, p. 195.

Types, *Halichondria panicea* and *incrassans*, Johnston. Vol. I, Plate XIX, Figs. 299, 300, 303, and Plate XXXV, Fig. 373.

2. HYALONEMA, *Gray*.

Skeleton an indefinite network of siliceous spicula, composed of separated elongated fasciculi, reposing on continuous membranes, having the middle of the sponge perforated vertically by an extended spiral fasciculus of single, elongated, and very large spicula, forming the axial skeleton of a columnar cloacal system. Vol. I, p. 195.

Type, *Hyalonema mirabilis*, Gray. Vol. I, Plate XXXV, Figs. 374, 375.

3. ISODICTYA, *Bowerbank*.

Skeleton without fibre; composed of a symmetrical network of spicula; the primary lines of the skeleton passing from the base or centre to the surface, and the secondary lines disposed at about right angles to the primary ones. Propagation by internal, membranaceous, aspiculiferous gemmules. Vol. I, p. 197.

Types, *Isodictya palmata* and *Normani*. Vol. I, Plate XXXVI, Fig. 376.

**4. SPONGILLA, Linnæus, Lamarck, and Johnston.**

Skeleton without fibre, composed of a symmetrical network of spicula; the primary lines of the skeleton passing from the base or centre to the surface, and the secondary lines disposed at about right angles to the primary ones. Reproductive organs, ovaries, coriaceous and abundantly spiculous. Vol. I, p. 199.

All the species are inhabitants of fresh water. The best type of the genus is *Spongilla fluviatilis*, Johnston. For the structural form of the skeleton, see skeleton of *Isodictya Normani*. Vol. I, Plate XXXVI, Fig. 376; and for the ovaries, Plate XXII, Figs. 317, 318, 319, 320, 321, and Plate XXIII, Figs. 322, 323.

**Suborder IV. Spiculo-fibrous skeletons. Regularly fibrous. Fibres filled with spicula.**

1. *Desmacidon*, Bowerbank.
2. *Raphyrus*, Bowerbank.

**1. DESMACIDON, Bowerbank.**

Skeleton fibrous, irregularly reticulated. Fibres composed entirely of spicula arranged in accordance with the axis of the fibre, cemented together and thinly coated with keratode. Vol. I, p. 200.

Type, *Desmacidon fruticosa*, Bowerbank. Vol. I, Plate XIII, Fig. 264.

**2. RAPHYRUS, Bowerbank.**

Skeleton fibrous, but not horny. Fibre composed of a dense mass of siliceous spicula mixed together without order. Vol. I, p. 201.

Type, *Raphyrus Griffithii*, Bowerbank. Vol. I, Plate XIII, Fig. 265.

Suborder V. Compound reticulate skeletons, having the primary reticulations fibro-spiculate, and the interstices filled with a secondary spiculo-reticulate skeleton.

#### DIPLODEMIA, Bowerbank.

Skeleton fibrous. Fibres keratose, hetero-spiculous; combined with a secondary skeleton of irregular network of spicula; rete unispiculate, rarely bispiculate. Ovaries membranous and spiculous. Vol. I, p. 201.

Type, *Diplodemia vesicula*, Bowerbank. Vol. I, Plate XIV, Fig. 273; Plate XXXVI, Fig. 377; Plate XXIII, Fig. 324.

Suborder VI. Solid siliceo-fibrous skeletons. Skeletons reticulate. Fibres composed of concentric layers of solid silex, without a central canal. Reticulations unsymmetrical.

*Dactylocalyx*, Stutchbury = *Iphiteon* of the Museum Jardin des Plantes, Paris.

#### DACTYLOCALYX.

Skeleton siliceo-fibrous. Fibres solid, cylindrical. Reticulations unsymmetrical. Vol. I, p. 203.

Type, *Dactylocalyx pumicea*, Stutchbury. Vol. I, Plate XV, Figs. 274, 275, 276, and Plate XXV, Figs. 340, 341.

**Suborder VII.** *Ganaliculated*, siliceo-fibrous reticulated skeletons. Fibres composed of concentric layers of solid silex, with a continuous central canal. Reticulations symmetrical.

**FARREA, Bowerbank.**

Skeleton siliceo-fibrous. Fibres cylindrical, canaliculated. Reticulations symmetrical, rectangular. Vol. I, p. 204.

Type, *Farrea occa*, Bowerbank, MS. Vol. I, Plate XVI, Fig. 277.

**ORDER III.—KERATOSA.**

**Suborder I.** Solid non-spiculate kerato-fibrous skeletons.

1. *Spongia*, Linnaeus.
2. *Spongionella*, Bowerbank.

**1. SPONGIA, Linnæus.**

Skeleton kerato-fibrous. Fibre solid, cylindrical, aspiculous. Rete unsymmetrical. Vol. I, p. 205.

Type, *Spongia officinalis*, Linnaeus. Vol. I, Plate XIII, Fig. 261, and Plate XXXVII, Fig. 379.

**2. SPONGIONELLA, Bowerbank.**

*SPONGIA*, Sowerby and Johnston.

Skeleton kerato-fibrous. Fibres solid, cylindrical, aspiculous.

Rete symmetrical; primary fibres radiating from the base to the apex. Secondary fibres disposed at nearly right angles to the primary ones. Vol. I, p. 206.

Type, *Spongionella pulchella*, Bowerbank. Vol. I, Plate XXXVII, Fig. 380.

Suborder II. Solid semispiculate kerato-fibrous skeletons.

Skeleton partially symmetrical; primary lines of fibre radiating from the proximal to the distal parts of the sponge; fibres containing spicula. Secondary lines of fibres unsymmetrical, destitute of spicula.

The Bahama sponges of commerce are most of them members of this suborder.

#### **HALISPONGIA, Blainville.**

Skeleton kerato-fibrous. Fibres solid; primary fibres compressed, containing an irregularly disposed series of spicula. Secondary series of fibres unsymmetrical, cylindrical, without spicula. Vol. I, p. 207.

Types, several species of the Bahama sponges of commerce. Vol. I, Plate XXXVI, Fig. 378.

Suborder III. Skeletons kerato-fibrous; fibres solid, entirely interspiculous. Skeleton symmetrical.

1. *Chalina*, Grant.
2. *Ophlitaspongia*, Bowerbank.

#### **1. CHALINA, Grant.**

Skeleton fibrous. Fibres keratose, solid, cylindrical, and interspiculate. Rete symmetrical; primary lines radiating from the basal or axial parts of the sponge to the distal portions. Secondary lines of fibre at about right angles to the primary ones. Vol. I, p. 208.

Type, *Chalina oculata*, Bowerbank. Vol. I, Plate XIII, Figs. 262, 263.

**2. OPHLITASPONGIA, Bowerbank.**

When the "Tabular View of Systematic Arrangement" was published, in page 159, Vol. I, of this work, no sponge, with which I am acquainted, having the structural peculiarities of this genus, had been systematically named or described. The spiculated fibres of one Australian and two West Indian species were figured in Plate XVII, Figs. 288, 289, 290, and their structural peculiarities described in pages 275, 276, as instances of the forms and positions of internal defensive spicula. Since this period, in June, 1865, I have received a specimen of a species washed ashore at Vazon Bay, Guernsey, and found with numerous other well-known British sponges, by Mr. Cooper, of Rohais, who presented the greater portion of the specimen to the Rev. A. M. Norman, from whom I obtained it for description. It therefore becomes necessary that the genus should be characterised, and added to the other British genera in this synopsis, following that of Chalina in the third sub-order of the order Keratosa, and I propose the following as its characters.

**OPHLITASPONGIA, Bowerbank.**

Skeleton fibrous. Fibres keratose, solid, cylindrical, and exterspiculate. Spicula based on the surface of the fibre, and radiating thence at various angles, either singly or in groups. Rete symmetrical.

The type species *O. papilla* is the only British species with which I am acquainted; but amongst the Australian and West Indian sponges the species are, I believe, by no means few in number. As far as they have yet been examined, they appear all to harmonise with the generic description of the British specimen, but the defensive spicula with which, in all cases, they are profusely furnished

differ in size, form, and mode of arrangement, to so great an extent as to afford the means of very satisfactory specific descriptions.

**Suborder IV.** Simple fistulo-fibrous skeletons. Cavity of the fibre simple, central, and continuous.

**VERONGIA, Bowerbank.**

**SPONGIA FISTULOSA, Lamarck.**

Skeleton kerato-fibrous. Fibres cylindrical, continuously fistulose, aspiculous. Rete unsymmetrical. Vol. I, p. 209.

Type, *Verongia fistulosa* (*Spongia fistulosa*, Lamarck). Vol. I; Plate XIII, Fig. 266.

**Suborder V.** Compound fistulo-fibrous skeletons. Central cavity of the fibre single and continuous, having secondary cæcoid branches radiating from it at nearly right angles.

**AULISKIA, Bowerbank.**

Skeleton kerato-fibrous. Fibres aspiculous, cylindrical, continuously fistulose, primary fistulæ having minute cæcoid canals radiating from them in every direction. Rete unsymmetrical. Vol. I; p. 210.

Type, a fragment of the skeleton in the cabinet of the author. Vol. I, Plate XIV, Fig. 268, and Plate XIII, Fig. 267.

**Suborder VI.** Regular semi-areno-fibrous skeletons. Skeleton regular areno-fibrous, having a well-defined

central line of grains of extraneous matter within the fibres.

**STEMATUMENIA, Bowerbank.**

**Skeleton.** Primary fibres solid, more or less compressed, containing a central axial line of spicula and grains of extraneous matters. Interstitial structures abundantly fibro-membranous. Vol. I, pp. 211, 77, 66.

**Types.** Undescribed species in the cabinet of the author. Vol. I, Plate XII, Fig. 25 $\delta$ , and Plate XXXVII, Fig. 381.

**Suborder VII.** Irregular and entirely arenaceous skeletons. Skeleton irregularly arenaceous, having the skeleton-fibre filled from the centre to the surface with grains of extraneous matter.

**DYSIDEA, Johnston.**

**Skeleton.** Primary and secondary fibres principally irregularly arenaceous, occasionally regularly arenaceous. Secondary fibres, when destitute of extraneous matters, frequently tubular. Vol. I, p. 211.

Type, *Dysidea fragilis*, Johnston. Vol. I, Plate XIV, Figs. 270, 271, 272.

DESCRIPTIONS  
OF  
THE SPECIES.

ORDER I.—CALCAREA.

*Genus—GRANTIA*, Fleming.

1. *Grantia compressa*, Fleming.
2. — *ciliata*, Fleming.
3. — *ensata*, Bowerbank.
4. — *tessellata*, Bowerbank.

**1. GRANTIA COMPRESSA.**

Sponge. Compressed, foliaform, slightly pedicelled; surface even, armed with flecto-slavate spicula. Cloaca expanded to the form of the sponge, very large, armed internally with spiculated triradiated spicula; spicular ray short, attenuated. Mouths of cloaca from one to seven or eight, simple, unarmed. Oscula on the sides of the cloaca in depressed areas; as numerous as the interstitial cells. Pores inconspicuous. Skeleton: spicula equiangular and elongo-equiangulated, triradiate, the latter frequently having the two shorter radii exflected.

*Colour.*—Cream white.

*Habitat.*—Nearly all parts of the British coast; littoral, or parasitical on fuci to 8 or 10 fathoms deep.

*Examined.*—Alive.

This sponge varies exceedingly in size and shape. In the young condition it is usually more or less of an elongated oval form, having a single mouth to the cloaca, at the distal end of the sponge. In older specimens it expands laterally to a very considerable extent, becoming irregularly foliaform and angular at the margin, and at each angle there is usually a mouth to the cloaca. When left by the tide, or in a state of repose, the sides of the sponge are in close contact, and the mouths of the cloaca are closed, but when immersed in water and in full action the sponge becomes considerably distended, and the excurrent streams issue with much force from the mouths of the cloaca. The largest specimen of this species I have seen was collected from the Ipswich River by Dr. W. B. Clarke. It was five in length, and its greatest breadth three and a quarter inches, although of this comparatively enormous size the interstitial cells of the sponge differed very little in their proportions from those of the species of an ordinary size. Their diameter did not appear to be in any appreciable degree increased, but their length was nearly double that of the cells of an ordinary sized specimen of the same species.

The oscula at the proximal termination of the interstitial cells are grouped two or three together at the bottom of irregularly shaped depressed areas, formed by a compact network of triradiated spicula and membranous tissue.

The margins of these areas are often furnished with spiculated triradiate spicula, the spicular rays being projected most frequently at a slight inclination towards the mouth of the cloaca, forming to a certain extent a defensive system against intruders within that space, but they are not, as might be expected from the collapsing habit of this sponge, of any great length.

The exhibition beneath the microscope of the pouring forth of the excurrent streams from the oscula of this

sponge, and of the vivid action of the cilia within their margins, is one of the most interesting sights afforded by this tribe of animals. The whole of the phenomena attendant on this operation will be found described at length in my paper "On the Ciliary Action of the Spongiadæ," published in the 'Transactions of the Microscopical Society of London,' vol. iii, p. 137. It is exceedingly difficult to get a good view of the pores in this species, they are so completely hidden by groups of flecto-clavate spicula, the distal ends of which curve over the areas in which they are situated, each area being immediately over the distal end of the interstitial cells to which they are appropriated; they are seen best in half of a young dried specimen, by transmitted light and a linear power of about 250.

The normal form of skeleton spicula is equiangular triradiate, but subject to modification in accordance with the necessities of the parts of the structure in which they are situated; thus, in those which reach the inner surface of the sponge at the united bases of the radii they radiate in an equiangular direction; the one which passes inward down the sides of the interstitial cells continues straight, but is very much elongated, to give it a firmer hold of the surrounding tissues, while the other two radii, on arriving at the surface, are exflected near the middle of the rays to such an amount as will bury them level with the general plane of the inner surface of the sponge, so that at the basal portions of the radii the spiculum is equiangular, while at the apical portions of two of them they are rectangular, but this mixed form, it must be recollect, is not probably a normal one, but simply a modification of the equiangular triradiate spiculum.

## 2. GRANTIA CILIATA, Fleming.

G. CILIATA, Johnston.  
— PULVERULENTA, Johnston.

Sponge. Elongately oval, rarely globular, slightly pedicelled; surface papillated, hispid. Cloaca central,

cylindrical, nearly as long as the sponge; armed internally with spiculated, equiangular, triradiate spicula; spicular ray attenuated. Mouth of the cloaca armed with a thick ciliary fringe, of very long and slender acerate spicula; base of the fringe supported by large, short and stout, fusiform, acerate spicula. Oscula simple, very slightly depressed from the surface of the cloaca; as numerous as the interstitial cells. Pores inconspicuous. Interstitial cells, distal terminations more or less obtusely conical; furnished with a ciliary fringe of slender acerate spicula. Skeleton spicula equiangular triradiate.

*Colour*.—Cream white.

*Habitat*.—Coasts of Great Britain, parasitical on fuci, littoral to 8 or 10 fathoms, or more.

*Examined*.—Alive.

This beautiful and interesting little sponge is frequently found associated with *Grantia compressa* on fuci, either littoral or dredged eight or ten fathoms deep. In the open sea or in littoral localities it seldom exceeds about five eighths of an inch in length, but in tidal rivers, and under some other peculiar circumstances, it attains much larger dimensions. Dr. Johnston, on the authority of the late Professor Edward Forbes, figures it (plate xx, fig. 4, 'History of British Sponges') three inches in length and three fourths of an inch in diameter, and I have specimens dredged in the Ipswich river, by Dr. W. B. Clarke, two and a half inches long and half an inch in diameter. These great dimensions are evidently cases of excessive development, and in the sponges for which I am indebted to Dr. Clarke are probably produced by the large amount of nutriment derived from the drainage of the populous town of Ipswich.

In the living condition the surface of the sponge, when examined with a lens of two inches focus, appears to be completely covered with minute conical papillæ, from which a few slender sharply pointed spicula are projected. When

dried these conical papillæ are transformed into dense pencils of long spicula, and the whole sponge assumes a very hirsute appearance. The bundles of spicula are often seen, in the dried specimens, reclining on the surface of the sponge in every imaginable direction. The cloaca in young specimens is often disproportionately narrow, but in adults it is sometimes one third the diameter of the sponge in width; it is narrowest near the base of the sponge, and gradually enlarges towards its apex.

As the sponge has evidently a considerable amount of expansive and contractile powers, these differences in the diameters of the cloaca may in many instances depend on whether the animal had died in a fully distended or a completely contracted condition.

The spiculated triradiated spicula with which the interior of the cloaca is armed are not very numerous, and the points of the defensive rays are usually directed more or less towards the distal end of the sponge.

The mouth of the cloaca is profusely furnished with the long defensive acerate spicula; they are very slender and flexible, and often exceed the eighth of an inch in length. At the insertion of their bases into the curving termination of the sponge there is intermingled with them a considerable number of stout, short, fusiform-acerate spicula, which renders that portion of the spicula forming the ciliary ring quite inflexible, so that when the mouth of the cloaca is distended by the force of the excurrent stream the ciliary spicula, which in the quiescent state of the sponge were all converging towards its axial line, are now by the distension of the mouth of the cloaca carried into positions, which often exceed those of lines parallel to the long axis of the sponge. The action of the separation or approximation of the distal points of the long defensive spicula is, therefore, simply due to a wise and beautiful mode of insertion into the distal termination of the sponge, and their motions are in no degree dependent on muscular action.

Besides the spicular defences of the mouth of the cloaca, I have in two cases found a tense membrane at the base of the neck of the cloacal orifice, entirely closing it, and this

was not merely a clean film that might possibly have been formed by a small bubble of sarcode shed from the animal during or after death, but, like the other membranes of the sponge, there were numerous spicula imbedded in its surface, and in this and in other respects of appearance and position the membranes in both cases were alike. It appears, therefore, probable that, besides the closing of the mouth of the cloaca by the approximation of the distal termination of the ciliary spicula, it has also the power of completely closing it by the extension of a veiling membrane, like that of an osculum.

Since the period of my researches into the ciliary action in *Grantia compressa* I have not had *G. ciliata* in a living condition, and the precise characters of the oscula are not so readily to be seen in the dried specimens in the latter species as in the former one; but there is a great similarity between them, and I have little doubt but that if a specimen of *G. ciliata* were to be divided longitudinally and placed in a cell with fresh cold salt water, and viewed as a transparent object with a linear power of about 500, the ciliary action would be as readily demonstrated in this species as in *G. compressa*, as the tessellated cells abound on the inner surface of the interstitial cells to as great an extent as they do in the last-named species.

The pores of this sponge are so completely hidden by the cone of defensive spicula that surrounds them that I have never succeeded in obtaining a view of them from the outer surface, but under favorable circumstances, when a section of one of the interstitial cells is made so as to allow of an oblique view of the inside of its conical termination, they are seen to occupy all parts of the cone, and are best observed by the aid of a Lieberkühn and a power of about 150 linear; they are tolerably numerous, and I have seen four in the space that would be occupied by one of the tri-radiate spicula. The mechanism of the ciliary appendages of the distal terminations of the interstitial cells is truly simple and beautiful.

In the dead specimens we find the ciliary appendages usually closed; the distal apices of the spicula are brought

together, forming a common point, and within this hollow cone of spicula the distal termination of the interstitial cell may be observed considerably elongated, gradually attenuated at that part of its parietes where the proximal ends of the ciliary spicula are attached, and this gradual inclination of the side of the cell towards its long axis necessarily effects a corresponding inclination of the circle of ciliary spicula, thus producing by the simple collapse of the distal end of the cell the same effect that would have been achieved by muscular action in animals of a higher order of structure. In the contrary condition of the ciliary circle of defensive spicula, where they are all projected in lines parallel to that of the central axis of the cell, and forming an open cylindrical tube, we find the part of the cell to which their proximal ends are attached in a fully expanded condition, and the extreme distal end of the cell terminating hemispherically, and sometimes more obtusely.

Thus, by the simple and natural act of the inhalation of water and consequent distension of the distal extremity of the interstitial cell, the cone of spicula is expanded into a cylinder, and the ready access of nutritive particles to the pores is promoted; but the moment that action becomes languid, or ceases altogether, a collapse of the cell ensues, and the distal points of the spicula again approach each other. The distal ends of the interstitial cells are not in contact with each other until slightly below the points of attachment of the proximal ends of their defensive ring of spicula, and in their semi-collapsed condition they bend over in any direction with perfect facility, and this amount of flexibility is thus an effectual safeguard to these delicate but yet brittle defensive organs, the spicula of which are stouter and very much shorter than those surrounding the mouth of the cloaca.

The equiangular and triradiate spicula of the skeleton vary considerably in size and form, and one or two of the three rays are frequently more or less curved, to adapt them to the purpose of their position, and occasionally one ray will be considerably longer than either of the other two. I have described and figured the anatomical peculiarities of

this sponge at greater length, in a paper published in the 'Microscopical Journal,' vol. vii, 'Trans. Micr. Soc.,' p. 79, pl. v.

About the year 1841 or 1842 I received from my friend the late Mrs. Griffiths, of Torquay, six specimens of small *Grantias*, which were designated by her "*Grantia pulverulenta*, *Spongia Ananas* of Montagu." The whole of these specimens agree perfectly with the description of *Spongia pulverulenta* as given by Dr. Grant, and with Montagu's description of *Spongia Ananas*, and the pulverulent character was apparent on all of them; but on examining them with a power of 130 linear, by the aid of a Lieberkühn, I found the pulverulent character arose from their being well-worn specimens, having nearly all the pencils of spicula so prominent in uninjured individuals of all ages and sizes of *G. ciliata* broken off close to the summits of the interstitial cells, excepting only in parts near the basal attachment, where they had been protected from attrition, and the ciliary defensive spicula of the mouth of the cloaca had suffered in a similar manner. I cut up and examined minutely the most characteristic of these specimens, but I could not find the slightest structural difference between it and specimens of well-developed *Grantia ciliata*, and among the numerous specimens I possess of the last-named sponge I found several that from partial injury presented on one side the pulverulent character, while on the other they were unmistakably *G. ciliata*. I am therefore inclined to believe that *Grantia pulverulenta* of Drs. Grant, Fleming, and Johnston, is but a stunted and worn form of *G. ciliata*, and is, therefore, not entitled to specific distinction.

This species runs into a great variety of forms. I have specimens which have assumed the shape of depressed spheres, considerably wider than they are long; others are ovate, and some are seven or eight times their diameter in length; but in none of these extreme varieties of form have I been able to detect any difference in their structural characters. In some cases the defensive spicula of the inhalent system are rather stouter than in others, but this is probably only an effect of locality.

**3. GRANTIA ENSATA, Bowerbank..**

Sponge. Elongately oval, sessile; surface smooth, furnished abundantly with large fusiformi-acerate spicula, disposed in lines parallel to the long axis of the sponge. Cloaca central, cylindrical, nearly as long as the sponge, armed internally with spiculated, equiangular, triradiate spicula; spicular ray ensiform, very long; mouth of cloaca simple, unarmed. Oscula simple, slightly depressed, as numerous as the interstitial cells. Pores inconspicuous. Skeleton spicula equiangular triradiate.

*Colour.*—Cream white.

*Habitat.*—Guernsey, Mrs. Buckland.

*Examined.*—In the dried state.

I am indebted to my kind friend the late Mrs. Buckland for this new and interesting species. She found it at Guernsey, between high- and low-water marks, parasitical on *Corallina officinalis*. It is in size, form, and colour, so much like *Grantia ciliata* that a superficial observer would very probably mistake it for that species. Of four specimens in my possession, the largest is seven lines in length and two lines at its greatest diameter, the smallest is three lines in length and not quite two in diameter. All the specimens are sessile, the base of the sponge embracing the stem of the *Corallina* firmly. The defensive spicular rays arming the interior of the cloaca are remarkably long; the ray progressively increases in size from its insertion at the centre of the triradiate spiculum for about three fourths of its length, and then gradually attenuates to its distal extremity, where it terminates acutely, so that its outline is very like that of an ancient sword.

They are all of them more or less inclined towards the mouth of the cloaca, and their abundance and efficiency

render the arming of that part of the sponge unnecessary.

The spicular ray is much stouter and longer than the rays of the spiculum on which it is based. The external surface of the sponge is strengthened and supported most effectually by numerous very large, stout, fusiform-acerate spicula, which are all disposed in the direction of its long axis; they are readily to be seen by the aid of a lens of an inch focus.

#### 4. *GRANTIA TESSELLATA*, *Bowerbank*.

**Sponge.** Elongately oval, sessile; surface even, tessellated, densely hispid. Cloaca central, cylindrical, nearly as long as the sponge; armed internally with spiculated, equiangular, triradiate spicula; spicular ray ensiform, short, stout, and curved. Mouth of cloaca armed with a thick ciliary fringe of long, rigid, acerate spicula. Base of the ciliary fringe strengthened with numerous rectangulated triradiate spicula, with the coincident radii disposed at right angles to the ciliary spicula, and the third ray directed towards their bases. Oscula simple, slightly depressed, as numerous as the interstitial cells. Pores inconspicuous. Interstitial cells: distal terminations obtuse; furnished each one with a dense corymboid fasciculus of short acerate spicula. Skeleton spicula equiangular and rectangulated triradiate; radii attenuating, stout.

**Colour.**—Brown.

**Habitat.**—Guliot caves, Sark, Mrs. Buckland; off Fermain Bay, Guernsey, 13 fathoms, Rev. A. M. Norman.

**Examined.**—In the dried state.

I am indebted to my kind friend the late Mrs. Buckland, an able and enthusiastic zoologist, for this new and interesting species of *Grantia*.

In form and size it is very like *G. ciliata*, but the colour and the strikingly tessellated character of its surface at once distinguishes it from that species. The tessellated appearance is produced by the corymboid fasciculi of short acerate spicula, which are based one on the centre of each of the distal ends of the interstitial cells, and the spicula of which diverge slightly from each other until, meeting the apices of the adjoining fasciculi, they mutually compress each other into four-sided figures; but although these bundles present so dense an aspect at their distal terminations, there appears always a free space around each of their proximal ones, by the means of which free access to the external water is afforded to the pores after all large extraneous matter has been separated by the distal terminations of the fasciculi. The difference that exists in the defences of the porous systems of this species and that of *Grantia ciliata* is very remarkable and interesting. The same end is attained in each, but by completely opposite contrivances.

The internal defences of the cloaca are remarkably stout and abundant. The external defensive organ also, although apparently like that of *G. ciliata*, differs from it in structure in several essential points. Thus, in *G. ciliata* the ciliary spicula around the mouth of the cloaca are remarkably long, slender, and flexible, and are, therefore, supported at their bases by short but very strong acerate spicula; while in *G. tessellata* we find the ciliary spicula stouter and very much more rigid than in the kindred species, and there is, accordingly, a total absence of the large acerate subsidiary spicula; but as some support of the proximal ends of the ciliary spicula appears to be still necessary, we have them bound together at their bases, for about one third or one fourth of their length, by a beautiful regular interlacement of rectangulated triradiate spicula. Again, the same end being attained in each species by an admirable variety of construction.

The whole of the spicula of this sponge are stouter in their proportions than those of *G. ciliata*. I have seen but two specimens of this species; they are both of about

the same size and proportions, and not exceeding five lines in length and a line and a half in diameter.

*Genus—LEUCOSOLENIA, Bowerbank.*

- 1. *Leucosolenia botryoides*, Bowerbank.
- 2. — *contorta*, Bowerbank.
- 3. — *lacunosa*, Bowerbank.
- 4. — *coriacea*, Bowerbank..

**1. LEUCOSOLENIA BOTRYOIDES, Bowerbank.**

*GRANTIA BOTRYOIDES, Fleming.*

— — *Johnston.*

*SPONGIA* — *Ellis and Solander.*

Sponge. Arborescent, cylindrical, slightly pedicelled; parietes very thin; surface smooth. Cloaca very large, armed internally with spiculated equiangular triradiate spicula; spicular ray large and long, slightly curved; mouths of cloaca one or more, terminal, simple, and unarmed. Oscula and pores inconspicuous. Spicula of skeleton equiangular, triradiate; radii somewhat short and stout, rapidly attenuating.

*Colour.—White.*

*Habitat.—Parasitical on fuci and zoophites, coasts of Great Britain, abundantly, littoral and to 8 or 10 fathoms.*

*Examined.—Alive.*

I have found this species abundant in eight or ten fathoms at Weymouth Bay, Tenby, Torbay, and in many other localities where I have dredged, and it is usually parasitical on small fuci, along with *Grantia compressa* and *ciliata*. When placed in a cell in a little somewhat turbid sea water, with a power of 150 linear, the excurrent streams are generally seen pouring forth strongly and steadily from the mouths of the cloaca.

Tufts of this species are frequently found exceeding an

inch in diameter ; and if these be carefully examined they will be found to consist of numerous individuals congregated together; and not of one complex sponge, as at first sight they might readily be thought to be. In the young state they appear as short unbranched cylinders, or with a single terminal branch ; others have two, three, or more short branches, each usually having a terminal cloacal mouth, but it is rather unusual to find them as much branched as the specimens represented by Ellis and Dr. Johnston. However much branched, there is never but one cloacal cavity, which extends throughout the whole of the sponge. The defensive radii within the cloaca are numerous, and many of them as long as nearly half the diameter of that organ, and they are slightly curved near the points in the direction of its mouth. The pores may be seen in dried specimens when viewed with a power of about 150 linear by direct light ; but when the interior surface is examined, either by direct light or when mounted in Canada balsam by transmitted light, it is very difficult to detect any regular orifice in the form of an osculum. The spicula of the skeleton, as compared with those of *Leucosolenia contorta*, the only known British species with which this sponge is liable to be confounded, are comparatively short and stout, and their radii, unlike those of *L. contorta*, decrease rapidly in diameter from the base to the apex. Ellis's figure of the spicula of *Spongia botryoides* is very correct.

## 2. LEUCOSOLENIA CONTORTA, Bowerbank.

Sponge. Sessile; a mass of confluent anastomosing fistulæ ; parietes thin ; surface smooth, with a few procumbent acerate spicula. Cloaca very large, continuous, armed internally with spiculated, equiangular, triradiate spicula ; spicular ray short, stout, slightly curved ; mouths numerous, simple, and unarmed. Oscula and pores inconspicuous. Spiculae of skeleton equiangular

triradiate; "radii long and slender, attenuating very gradually.

*Colour.*—White.

*Habitat.*—Guernsey, Mrs. Buckland; Scarborough? Mr. Bean; Guliot Caves, Sark, J. S. Bowerbank.

*Examined.*—In the dried state.

I am indebted to my kind friend the late Mrs. Buckland for twenty-eight specimens of this little species. The largest does not exceed half an inch in length, a quarter of an inch in breadth, and about two and a half lines in thickness, and the attachment rather exceeds a quarter of an inch in diameter. The smallest specimen is about one line in length and half a line in breadth. The whole of the specimens are either coating in habit or have very broad basal attachments, or, if seated on a fine branching fucus, instead of being partially pedicelled after the habit of *L. botryoides*, it appears always to embrace and envelop the small branches of the fucus in its neighbourhood. The spaces between the inoculating fistulæ seldom exceed one and a half time the diameter of those tubes, and are frequently not more than half their diameter in width, and all the specimens in my possession are uniform in their structure in this respect.

The mouths of the cloaca are numerous, and are usually at the termination of short lobular projections of the sponge. The spicular ray of the internal defensive spicula are very much shorter in proportion than those of *L. botryoides*, rarely exceeding one fourth or one fifth of the interior diameter.

From these and other general differences in character from the ordinary arborescent forms of *L. botryoides*, I was at first induced to believe that this sponge might probably prove to be *Spongia complicata* of Montagu; but Montagu's figure in plate ix, vol. ii, of the 'Transactions of the Wernerian Society,' does not represent the contorted character of our sponge, while it is really a very characteristic figure of *Spongia botryoides* of Ellis and Solander,

or *Grantia botryoides* of Fleming ('British Animals,' p. 525). Montagu also states that the spicula of *L. botryoides* are more than four times as large as those of his *S. complicata*, while the spicula of the species under consideration are not quite so stout at the bases of the radii, but are very much larger than those of *Grantia botryoides* of Fleming, and that author, who sent the specimens to Montagu, repudiates his species. Dr. Grant, who also treats of *S. complicata* of Montagu in his paper "On the Structure of some Calcareous Sponges,"\* likewise received his specimens from Dr. Fleming. Dr. Johnston, also, with good reasons for his conclusion, rejects Montagu's species as but a variety of *S. botryoides*. Under these circumstances I think it is better to reject the term *complicata*, and to adopt that of *contorta* for the species under consideration.

The form of this sponge is so distinctly different from that of *L. botryoides* that, with the assistance of a lens of two inches' focus, it cannot be well mistaken for that species, which, although they are frequently congregated in groups, have not apparently the habit of uniting together in one mass by inosulation, while *L. contorta* always appears to consist of a mass of contorted inosculated fistulae. Besides this variation in external form, there is a distinct difference existing between the skeleton spicula of the two species, for, although both are equiangular triradiate, their proportions are very different from each other, those of *L. botryoides* being proportionally much stouter and having much shorter radii than those of *L. contorta*. The rays of the former also attenuate rapidly and regularly from base to apex, while those of the latter retain nearly the same diameter, or are attenuated very gradually until near the apices, and are then more suddenly acuminate, so that when the eye has become familiarised with the two the species may be readily decided by the forms of the spicula only. The external surface of *L. contorta* is also sparingly furnished with recumbent acerate spicula, mostly disposed in a longitudinal direction, and I have never observed like spicula on the surface of *L. botryoides*.

\* 'Edinb. Med. Phil. Journ.,' i, 169.

In the dried condition *L. contorta* and *coriacea* are more liable to be mistaken for each other than the former and *L. botryoides*, but the total absence of defensive spicula on the cloacal cavity of *L. coriacea* readily distinguishes it from either of the other two species.

### 3. LEUCOSOLENIA LACUNOSA, *Bowerbank.*

*GRANTIA LACUNOSA, Johnston.*

**Sponge.** Massive, more or less elliptical, pedicelled; surface smooth; fistulæ tortuous. Cloaca unarmed internally; mouth simple, single, and unarmed. Pores inconspicuous. Skeleton: spicula equiangular triradiate; radii very slightly attenuated until near the apices, termination rather obtuse, and a few long acerate spicula near the base of the sponge.

**Colour.**—Light gray or white.

**Habitat.**—On rocks at low water near Scarborough, very rare, Mr. Bean; in deep water, coast of Ireland, Mr. Hyndman; Shetland, Mr. C. W. Peach.

**Examined.**—In both the fresh and the dried state.

The specimen of this sponge figured and described by Dr. Johnston in his 'History of British Sponges,' p. 176, has the body of the sponge five lines in height and two in breadth, while a dried specimen in my possession, for which I am indebted to my friend Mr. Bean, has the same part two and a half lines in height and four in breadth, the proportions in this case being nearly reversed; the pedicel in both is nearly of the same height. Dr. Johnston describes the species as "flabellate, entire or undivided, white, greatly compressed, the sides perforated with numerous irregularly elliptical holes or vents, so as to give a lacunose appearance to the dried specimen; structure compact, friable when dry; spicula all triradiate. The remarkable character afforded by the numerous large holes in the sides,

so unlike the faecal orifices of the other species, distinguishes this at once, and removes the suspicion of its being a variety of any other."

Nearly the whole of the above description is incorrect, the errors arising from the description having been made from a dried and artificially compressed specimen. I have been more fortunate in this respect than my late friend the author of the 'History of the British Sponges,' having been kindly presented with a specimen dredged in deep water and preserved in spirit, in September, 1858, by my friend Mr. George Hyndman, of Belfast. This beautiful little specimen is based in a depression on a small fragment of stone, the whole sponge being about six lines in height, three lines consisting of a curved pedicel of nearly uniform size, having a diameter of about one third of a line, and the remainder of the body of the sponge assumes the form of a regular ellipse, the greatest diameter of which is about a line and a half. The body consists of numerous fistulæ, which spring from the apex of the solid pedicel and assume a longitudinal direction, frequently anastomosing with each other in their progress towards the distal extremity of the body of the sponge. A portion of the fistulæ of the interior discharge their contents into a central cloacal cavity, which is somewhat irregular in form, and gradually increases in its diameter from its origin at the proximal end of the body until it reaches nearly its distal termination, where it expands into a large irregularly conical cavity, into the base of which the longitudinal fistulæ of the surface discharge themselves, and at the apex of the cone and of the body of the sponge there is a single circular mouth to the cloaca of about the same diameter as that of one of the fistulæ of the sponge. I sliced off a portion of a dried specimen of the sponge in a longitudinal direction, and thereby obtained a view of a portion of the cloaca, but I could not detect the slightest indication of internal armature in that organ, nor could I in any part of the sponge find a single spiculated triradiate spiculum. Nor is there any indication of external defensive spicula at the mouth of the cloaca. The whole of the surface of the interior of the

fistulæ and central cloacal cavity is abundantly furnished with circular nucleated cells varying in diameter from  $\frac{1}{100}$ th inch to  $\frac{1}{500}$ th inch; they are regularly dispersed, and are seldom more than about the length of their own diameter distant from each other. The nuclei occupy from one third to about two thirds of the diameter of the interior of the cell, and neither in it nor in the cell surrounding it is there any appearance of granules. I could not detect any of these cells in the dried specimen of the same species for which I am indebted to my friend Mr. Bean, nor have I ever seen similar cells in any other calcareous sponge. It is difficult in the present limited state of our knowledge of this tribe of sponges to determine the office of these bodies in the economy of the sponge, but it is most probable that they are the reproductive organs.

#### 4. LEUCOSOLENIA CORIACEA, *Bowerbank.*

**GRANTIA CORIACEA,** *Fleming.*  
— — — *Johnston.*

Sponge. Sessile incrusting; fistulæ tortuous, anastomosing; surface smooth, parieties thin. Cloacal cavity continuous, unarmed internally; mouths inconspicuous. Oscula and pores inconspicuous. Spicula of skeleton equiangular triradiate, radii thick, apices obtusely pointed.

**Colour.**—Dark crimson, Mrs. Buckland; dirty bluish gray or white, Johnston; lemon yellow, Rev. A. M. Norman; deep nut brown, J. S. Bowerbank.

**Habitat.**—Scarborough, Mr. Bean; Peterhead, Mr. Peach; Guernsey, Mrs. Buckland; Berwick Bay, Johnston; Guliot Cave, J. S. Bowerbank; Burra-Firth Cave, Rev. A. M. Norman.

I found this sponge by the aid of my friend Mr. Bean of Scarborough, and I have also received it from him in the

dried state. In both cases it was closely attached to and coating the piece of rock on which it was seated. Mrs. Buckland found it at Guernsey. On a small slip of paper accompanying the specimen she has written : " What are these Grantiæs, some are dark crimson when living on sponges at low water ? " Examined by the microscope in a little water these specimens exhibit an abundance of red sarcodes. Dr. Johnston describes them as of a " dirty bluish gray or white when recent." The specimens I found myself were of a dark brown colour. It would appear therefore that this species varies considerably in that character. The body of the sponge is composed of tortuous fistulæ anastomosing in every direction, the spaces between them being usually very much less than the diameter of the fistulæ themselves. The parieties of the sponge are thin and the surface smooth, and I have never found more than one form of spicula in any part, the equiangular triradiate ones of the skeleton ; these spicula are very much like those of *L. contorta* in size and proportion, but the radii are more obtusely terminated than in that species.

The cloacal cavity is continuous and totally without defensive spicula, and by this character the species may always be distinguished from *L. contorta*.

Dr. Johnston in treating of this sponge says, " There are no faecal orifices." I have carefully examined a considerable number of specimens with a microscopic power of 160, but have been unable to detect any of the mouths of the cloaca, and attribute this failure to the habit of the animal of closing those orifices at the approach of danger, or while in a state of inaction, and the total absence of internal defensive spicula, would seem to indicate the existence of such a power for its protection from its enemies. In *L. contorta* the mouths of the cloaca are at the distal ends of tuberous projections of the sponge, some of these appear fully open, others with a very small orifice apparent, while others are entirely closed, and in this condition no arrangement of the skeleton spicula different from that of other parts of the sponge is apparent that would indicate the place of the mouth of the cloaca ; and this may very

probably be also the case in *L. coriacea*, which in the structure of its parieties very closely resembles those of *L. contorta*.

Montagu's description of his *Spongia coriacea* applies very much more correctly to a small specimen of *Raphyrus Griffithsii* of this work than to the calcareous species described above.

This sponge has been found as far north as Davis's Straits by Dr. Walker, who presented a specimen of it to Professor Dickie of Queen's College, Belfast, from whom I received it for examination in the autumn of 1858. The specimen differed in no respect from those which I have received from Guernsey.

### *Genus—LEUCONIA, Grant.*

1. *Leuconia nivea*, Bowerbank.
2. — *fistulosa*, Bowerbank.
3. — *pumila*, Bowerbank.

#### **1. LEUCONIA NIVEA, Bowerbank.**

*GRANTIA NIVEA, Fleming.*  
— — *Johnston.*

Sponge. Sessile, massive or coating; surface lobular or crested, smooth. Cloacæ numerous, mouths simple, armed internally with very large and stout equiangular spiculated triradiate spicula, radii attenuated. Membrane of cloaca furnished abundantly with unicurvo-cruciform spicula. Oscula numerous, simple, dispersed over the surfaces of the cloacæ. Pores minute. Spicula of skeleton equiangular triradiate, very variable in size and stoutness. Spicula of interstitial and dermal membrane small, acerate; and minute attenuato-spiculated triradiate spicula; spicular ray short, basal rays tripodate.

*Colour.*—White.

*Habitat.*—Scarborough, Mr. Bean; Guernsey and Sark, Mrs. Buckland, and J. S. Bowerbank.

*Examined.*—In the dried state.

The specimens of this sponge, which I have received from my friend Mr. Bean, of Scarborough, are thin, with sinuous crests running over the surface, on the highest part of which are the mouths of the cloacæ. Those from my late friend Mrs. Buckland; and also those I have found, were from the Guliot Caves, Sark, and other localities in the Channel Islands; these specimens are more massive, and the surface is furnished with from one to seven or eight conical lobes, each terminated by the mouth of a cloaca. The cloacæ are separate and distinct organs, at the base of each there is usually the terminations of one or more large excurrent canals; and on all parts of the walls of the cloaca there are numerous dispersed oscula. The defensive spicula of the parieties of the cloacæ are remarkable, and disproportionately large. The equiangular triradiate bases are buried deep in the interstitial tissues, while the spicular rays passing through the walls of the cloaca project for about half or two thirds their length into its cavity, presenting a formidable array of weapons to greet any intruder, while the basal radii perform an important part in strengthening the skeleton. The basal radii of some are nearly approaching to the rectangular form, but the normal form is equiangular.

The unicurvo-cruciform spicula abound on the membranes lining the cloacæ of the sponge. Their axial radii are disposed very nearly in the direction of the long axis of those organs, and the curves formed by the lunate radii always have their points towards the mouth of the cloaca. They are always lying on one of their flat sides, and when undisturbed I have never seen any one of the radii projected out of the plane of the membrane on which they are reposing. The apical ray often projects for the whole of its length over the margin of the terminal orifices of the interstitial excurrent canals, so as to appear to perform the

office of a defensive spiculum, but as we find no similar projection of defensive spicula on the opposite side of these terminal orifices, it is evident that this position is accidental rather than premeditated. I could not find any of these spicula on the interstitial membranes of the sponge, between the lining membrane of the cloaca and the dermal membrane.

The pores are minute and are best seen by direct light with a power of about 160 linear. They are situated in the areas of the dermal membrane, which are formed by the network of equiangular triradiate spicula, by which it is supported; every area has not a pore, but sometimes one large area will have two or three, but one is the more usual number.

The triradiate spicula of the skeleton are very variable in size and strength; some of them are quite as large as the triradiate bases of the large defensive spicula of the cloaca, and these are placed along with the basal portions of those spicula, about midway between the dermal membrane and the parieties of the cloaca; while the rest of the skeleton spicula do not exceed in size the ordinary dimensions of those of the whole tribe of such sponges.

The dermal and interstitial membranes abound in small acerate tension spicula, and with minute, attenuated, spiculated triradiate ones. The spicular ray rarely exceeds in length a third or a fourth of the length of one of the basal radii, and the basal rays are not, as it is usually the case, in the same plane, but are projected backward in an equal degree, forming, as it were, a tripod support to the spicular ray.

The sponge does not appear to attain a greater size than about one and a half or two inches in diameter; the specimens from Sark and Guernsey are smaller than those from Scarborough in diameter, but very much more lobular and elevated.

**2. LEUCONIA FISTULOSA, Bowerbank.****GRANTIA FISTULOSA, Johnston.**

Sponge. Fistular, sessile; surface hispid, with large, stout, fusiformi-acerate spicula. Cloaca single, central, cylindrical, nearly as long as the sponge; armed internally with spiculated equiangular triradiate spicula; spicular ray attenuated; mouth of cloaca simple or very slightly fringed with short, slender, acerate spicula. Oscula simple, numerous, disposed irregularly over the surface of cloaca. Pores inconspicuous. Skeleton spicula. Large, stout, fusiformi-acerate; equiangular triradiate, radii attenuated, long, and slender; and slender rectangular triradiate spicula; coincident radii very long, angulating ray very short.

*Colour.*—Pure white alive; cream white dried.

*Habitat.*—Plymouth, Mr. John Howard Stewart; off Saint's Bay, Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

I am indebted to my late friend Mr. John Howard Stewart of the Royal College of Surgeons, for the loan of two specimens of this sponge. He found them on the rocks of the Eddystone Light House at low water. The largest one is two inches in length, and seven lines in width, at about one third its height from the base. It is somewhat compressed, and is irregular in form, one side being straight, while the other is sinuously curved. The other specimen is one inch and a quarter long; nearly cylindrical in form, but curved to about the fifth part of a circle. I have also a specimen that was presented to me many years ago by my late friend Professor Edward Forbes, who could not recollect the locality. It is two inches and two lines long, four lines at its greatest diameter; is nearly cylindrical and is curved into a slightly sigmoid figure.

From the description given by Dr. Johnston, in page 181 of his 'History of British Sponges,' of *Grantia fistulosa*, there is little room to doubt that the sponge sent to him by Mr. William Thompson, and those found by my friends Mr. Stewart and Professor Forbes are of the same species; but from the structure of the latter specimens, it is quite certain that they cannot be considered as *Grantias* according to the structural limitations of that genus.

In Mr. Stewart's and Professor Forbes's sponges, there is not the slightest indication of the large, regular, interstitial cells that radiate from the central axis of the sponge in *G. ciliata* or *compressa*; although there is a large central cloaca as in those species. On the contrary, the whole of the walls of the animal closely resemble a halichondraceous sponge in structure, and is permeated as in that tribe by numerous contorted canals, the excurrent orifices of which are at the inner surface of the sponge; which forms one great cloacal cavity as in the true *Grantias*. I have, therefore, referred these sponges to the new genus *Leuconia*.

The spicula with which the external surface is armed are very stout and strong, but not so very numerous; they are similar in size and strength to the large fusiform-acerate ones, which are recumbent, principally in a longitudinal direction at the surface of the sponge, but the defensive ones are considerably longer of the two.

The principal part of the skeleton is constructed of the slender equiangular triradiate spicula, and the rectangular triradiate ones are found more especially at the outer surface, and also near the mouth of the cloaca, where they are disposed with the long coincident radii most frequently at right angles to the long axis of the sponge, and the angulating ray pointing backwards, thus forming a strong but light and elastic interlacing structure.

The cloaca is very capacious and abundantly armed with spiculated equiangular triradiate spicula; the spicular ray being long, slender, and gradually attenuating, and they are all slightly curved in the direction of the mouth of the cloaca.

The slender acerate spicula forming the very meager

ciliary defensive sponge, are very short and few in number. The pores in Professor Forbes's sponge are barely visible with the aid of a two inch lens. The oscula are very numerous and minute, but they are visible to the unassisted eye in dried specimens.

From the difference in the form and size of the specimens under consideration, it would appear that this species is subject to much variation in both of these characters.

Since the above was written, my friend the Rev. A. M. Norman has taken fourteen specimens of this sponge off Saint's Bay, Guernsey, in 1865, several of them rather exceeded two inches in length, and three of them did not exceed seven lines in length, with a proportionate decrease of diameter, the others were intermediate between the two extremes; in every other respect they agreed perfectly with the two specimens previously described.

### 3. LEUCONIA PUMILA, *Bowerbank.*

Sponge. Sessile, elongo-oval, surface smooth; oscula simple, on the parieties of the central elongated cylindrical cloaca. Internal defensive spicula, spiculated, equi-angular, or rectangular triradiate spicula; spicular ray short, attenuated. Cloaca cylindrical, extending from the base to the distal end of the sponge, mouth simple, membranous, thin. Pores inconspicuous. Skeleton spicula equi-angular, triradiate, very large and strong, variable in their proportions. Interstitial membranes. Spicula equi-angular, triradiate, small and slender.

*Colour.*—Cream white, alive and dried.

*Habitat.*—Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

Four specimens of this sponge were obtained by the Rev. A. M. Norman while dredging in company with Mr. Jeffreys, off Guernsey. The largest does not exceed

eight lines in length, by not quite two lines in greatest diameter, and the smallest measured four lines in length, and one, greatest diameter. The form and general aspect of the sponge is very like that of a young specimen of *L. fistulosa*, but the total absence of hispitation, and the very large size of the surface spicula renders them readily separable by the aid of a lens of two inches focus. The surface as well as the whole substance of the sponge is formed by a strong interlacing of exceedingly large triradiate spicula, the space covered by many of them being quite equal to half the greatest diameter of the sponge. These spicula vary to a considerable extent in their proportions, apparently in accordance with the necessities of their situation, and at the surface they frequently have one ray much longer than either of the other two, and in this case the elongated ray usually runs in the direction of the long axis of the sponge; besides these large and strong spicula, there is no indication of surface armature. The internal defensive spicula are not very numerous; the spicular ray is equally attenuated, and usually not more than about half the length of either of the others. The mouth of the cloaca is composed of a thin membrane strengthened and supported by slender rectangulated triradiate spicula, the margin being nearly purely membranous. The interstitial membranes are abundantly furnished with small equiangular triradiate tension spicula, disposed without any appearance of regularity.

*Genus—LEUCOGYPSIA, Bowerbank.*

**1. LEUCOGYPSIA GOSSEI, Bowerbank.**

Sponge. Massive, sessile; surface smooth; oscula terminal, slightly fistulose. Pores inconspicuous. Dermal membrane pellucid, furnished with a minute, irregular reticulation of small equiangular triradiate spicula, with

attenuated radii. Skeleton, interstitial cavities rather large, irregular in form. Excurrent canals large, rather numerous, congregated near the middle of the sponge; their parjeties abundantly armed with stout, spiculated, equiangulated triradiate defensive spicula; spicular ray large and stout; and also with slender rectangulated triradiate and spiculated rectangulated triradiate spicula; rectangulating rays short and slender. Spicula of the skeleton equiangulated, attenuated, triradiate, large, and stout; and a few very large and stout fusiformi-acerate spicula. Interstitial membranes pellucid, aspiculous.

*Colour*.—Cream white.

*Habitat*.—Torquay, Mr. Gosse; Guliot Caves, Sark, J. S. Bowerbank.

*Examined*.—In the dried state.

I am indebted to my friend Mr. Gosse for having called my attention to the differences in external characters of this species and similar sized specimens of *Leuconia nivea*. A slight microscopical examination of the specimens he sent me, sufficed to convince me that they were not only different as species, but that they were also members of a different genus, being the only British representative of the genus *Leucogypsia*; and on examining a considerable number of specimens of *Leuconia nivea* that I had collected from the Guliot Caves in Sark, I found among them four fine specimens of Mr. Gosse's sponge which I had overlooked amidst the abundant spoil of those prolific caves.

The form of *Leucogypsia Gossei* is massive, with a tendency to elongate upward in the larger specimens, which sometimes attain the height of an inch and a half, and at the distal extremity the oscula are usually found, sometimes as simple orifices, and at others as slightly elevated simple tubes, about half the height of their own diameter. The colour and variable form and size of these sponges renders them very liable to be confounded with *Leuconia nivea* by a hasty observer. The spicula of the dermal

reticulation are very small in comparison with those of the skeleton, their spread being not more than about one fourth part that of the latter, and the radii are slender and delicate in proportion to their diminished size. The interstices of the network are small in proportion, about equal in their area, but irregular in their form. The excurrent canals are variable in size, but usually rather large, and they are irregularly congregated about the middle of the sponge. They originate near its base, and gradually increase in diameter as they progress in nearly straight lines to its distal extremity; occasionally, but rarely, a canal may be observed to emerge in a lateral direction. The parieties of these canals are ~~simply~~ provided with defensive spicula; they are of three descriptions. The normal form is that of a stout equiangular spiculated triradiate spiculum; the spicular ray is not so long as either of the other rays, but is stout and usually slightly curved towards the oscular orifice. The other two forms may be considered as subsidiary defences; they are spiculated rectangular triradiate, and simple rectangular triradiate; the rectangulating ray in both is very short, usually not exceeding about one fourth the length of either of the other rays. The defensive organ in the first of these two forms is the spicular ray; in the second, it is the short angulating ray of the spiculum, the two long rays being usually disposed in a line with the long axis of the canal, while the short angulating ray is projected at about right angles to the surface of the canal; both these forms are much more slender than the equiangular defensive spicula, which are of about the same size as those of the skeleton. Immediately beneath the surface of the sponge there are very large fusiformi-acerate spicula disposed singly at nearly equal distances from each other, and in lines at right angles to the surface. Their diameter is three or four times that of the largest sized skeleton spiculum, and their length at least twice as great as the space embraced between any two of their angulating radii. Their distal apices do not appear to pass through the dermal membrane, but are ~~usually~~ slightly below it. A few of these large spicula

are found more deeply imbedded in the sponge; they may, therefore, be considered rather as subsidiary skeleton spicula than defensive ones. The interstitial membranes are abundantly present, they are thin and pellucid, and do not present the slightest indications of tension spicula.

## ORDER II.—SILICEA.

Genus.—*GEODIA*, Lamarck.

*GEODIA ZETLANDICA*, Johnston.

*ALCYONIUM CYDONIUM*, Jameson. Wern. Mem., i, 563.  
*CYDONIUM MULLERI*, Fleming. Brit. Animals, p. 516.

Sponge. Massive, sessile; surface even, strongly hirsute, with large fusiformi-acerate and fusiformi-acuate spicula projected at right angles to its plane. Dermal membrane thin, translucent, spiculous, spicula attenuato-stellate, abundant. Connecting spicula attenuato-patento-ternate, stout; and attenuato-recurvo-ternate, long, and slender, with rarely, slender porrecto-ternate spicula. Oscula dispersed, or occasionally congregated. Pores inconspicuous, minute, dispersed. Skeleton spicula fusiformi-acerate, large. Spicula of the interstitial membranes attenuato-stellate, variable in size; and also acerate, small, and slender. Gemmules globose, slightly depressed.

*Habitat*.—Island of Fulah and Unst. Jameson.

Cape of Good Hope? Fleming.

*Colour*.—Cream yellow.

*Examined*.—In the dried state.

The first record of this species is in Dr. Jameson's list of Scottish vermes, 'Memoirs of the Wernerian Nat. Hist.

Society,' vol. i, p. 563, where, under the head of *Alcyonium*, it is simply recorded as "*A. cydonium*, Island of Fulah and Unst." Dr. Fleming, in his 'History of British Animals,' p. 517, has described the sponge, and has changed the specific name into a generic one, and given it a new specific one, designating it *Cydonium Mulleri*. Dr. Johnston, in his 'History of British Sponges,' has correctly referred the sponge to Lamarck's previously established genus *Gedodia* ('Anim. S. Veit,' 2nd edit., ii, p. 593), but has changed the specific name to *Zetlandica*, apparently from being satisfied that Müller's *Alcyonium cydonium* was really *A. digitatum* of Ray and Linnaeus.

I am much indebted to Dr. Fleming for kindly sending me the type specimen for examination. It is an irregular, tuberous mass, the greatest diameter of which is two and a half inches, with several large and deep depressions, one of which is an inch across, and three fourths of an inch in depth, forming, when it stands on the cut base, a deep arched cavern in its substance. On each side, near the base of the walls of the cavern, there is a single large osculum, the eighth of an inch in diameter, and one of them has the membrane closing it remaining in a partial state of contraction, protruding, and exhibiting a central orifice about one sixth of a line in diameter, and near the greater one there is an irregular group of smaller oscula, and a few others, similar to the latter, are visible in the other depressed portions of the sponge. The true base of the sponge has been destroyed. In some of the natural depressions on the surface of the sponge there are the remains of large fusiform-acuate spicula, those protected portions of the surface having evidently been quite hirsute with them. The upper portion of the specimen is thickly studded with minute stellate depressions or pits; this pitting of the surface is caused by the contraction and depression of the dermal membrane, immediately above the distal orifices of the intermarginal cavities. Dr. Johnston says of the crust that it is "dimpled in some places with numerous pores placed pretty closely together, and large enough to be visible with the naked eye." These orifices are not the pores, but

they are the intermarginal cavities which receive the minute streams from numerous pores situated immediately above and within a short distance of them; the true pores perforating the dermal membrane are too minute to be visible without the assistance of considerable microscopic power. In the dried specimens these "dimpled" depressions of Dr. Johnston, or stellate orifices of Dr. Fleming, have the appearance of forming a well-marked character of the surface, while, in truth, I believe they are not visible on the surface of the sponge in its natural condition before it is dried; at least this is the case with *G. Barretti*. In the dried specimen they are apparent, but not in the slightest degree visible in any part of the same specimen that was preserved in salt and water while fresh from the sea; we may therefore reasonably conclude, that they do not form a character applicable to the description of the species.

In the present condition of the sponge the villous character described by Dr. Fleming is not in the slightest degree apparent, excepting in the depressed parts before mentioned, but if we examine a section of the sponge at right angles to its surface, we find that remains of large spicula passing entirely through the crustular dermis are abundant; they originate at a short distance beneath the inner surface, pass through the crustular mass, and project at least half their length beyond its outer surface. In its natural condition it would therefore be decidedly hirsute. There are also a few small acerate spicula at right angles to the surface, but these rarely project beyond the dermal membrane, and are not sufficiently long to reach the inner surface of the crust.

Where there are any remains of the dermal membrane it is profusely furnished with attenuato-stellate spicula, the same as those of the sarcodæ; but its dilapidated condition afforded very unsatisfactory information regarding the pores; apparently they are equally dispersed over its surface.

The connecting spicula are of two distinct forms, and are very large and long. The attenuato-expando-ternate ones are very stout and strong; the triradiate heads of this form are generally parallel to each other at the base of the

crustular dermis, and are slightly imbedded in its substance, while the attenuato-recurvo-ternate ones are less regularly disposed. The heads of some of these are intermixed with those of the expando-ternate ones at the inner surface, but a considerable number of them project their triple hooks deep into the substance of the crustular dermis, and occasionally almost reach the outer surface. The shaft of this form of spiculum is very slender compared with its length, which is greater than that of the expando-ternate ones, while the diameter is not above one fourth that of the latter; the shaft is also frequently flexuous. Occasionally, but very rarely, we find a specimen of porrecto-ternate spiculum mingled with the recurvo-ternate ones. The fusiform-acerate spicula of the skeleton are large and strong; their greatest diameter is not quite so much as that of the expando-ternate ones. The interstitial membranes are very abundant, they are of uniform texture, and, when free from sarcode, very pellucid. The type specimen has the membranes abundantly coated with sarcode, amidst which are numerous small, lentiform cells,  $\frac{1}{200}$ th of an inch in diameter. I did not detect these bodies in a specimen in my possession in which the sarcode is not nearly so abundant, probably from its having been cleaned by soaking in fresh water. The attenuato-stellate spicula of the sarcode are abundantly dispersed over the membranes; they are very variable in size, some not exceeding, from point to point of the rays,  $\frac{1}{200}$ th of an inch, while others attain an extreme diameter of  $\frac{1}{51}$ th of an inch; the radii of the largest of them, beneath a linear power of 660, exhibited a tendency to be incipiently spinous. The gemmules are uniformly globose; an average sized one measured  $\frac{1}{35}$ rd of an inch in diameter. I did not observe any of them in a young and productive state in the crustular dermis, but in those which were imbedded near the centre of the substance of my own specimen there were a considerable number in the young state having the opaque nucleus in the centre. This specimen I obtained from Mr. James de C. Sowerby; he has no recollection of its history, but says he had various specimens, many years since, from a man who used to collect for Colonel Montagu.

As I received at the same time a specimen of *Tethea lyncurium*, and the type specimen of *Spongia pulchella*, Johnston, described in the 'British Miscellany,' it is very probable that Mr. Sowerby had it from the man to whom he alludes, and that its locality was probably either Shetland or the Orkney Islands. It has the form of rather less than half of a depressed turnip. The section is two and three quarter inches in length and one and a half in height, and from the flat section to the furthest part of the opposite curve it measures one inch. It agrees completely in its organic characters with the type specimen.

When Dr. Fleming favoured me by sending to me the type specimen of his *Cydonium Mulleri*, he sent with it two other specimens; one of them is labelled, "From the Island of Dominica, in the West Indies," and proved to be *Geodia gibberosa*, of Lamarck; the other was labelled, "From the Cape of Good Hope." In this specimen I have been unable to discover such organic difference as to entitle it to be considered distinct from *G. Zelandica*. It is two and a half inches long, two inches broad, and one inch in height. The dermal membrane is entirely destroyed by washing or maceration, and nearly all the sarcode is removed from the sarcodous membranes by the same cause. There are hirsute spicula very closely set and numerous on some parts of the depressions on the surface, protruding nearly the eighth of an inch, and in other parts of the sponge, where none of them appear above the surface, their remains are equally abundant when a section at right angles to the surface of the sponge is observed by the microscope, and it is therefore evident that at one period of its existence it was hirsute on all of its external parts.

At the bottom of two deep, funnel-shaped depressions on the sponge, completely obscured by the great hirsute spicula, there appeared to be single oscula; these orifices were about the size of the large ones in Dr. Fleming's specimen of *C. Mulleri* (*Geodia Zelandica*), but I could not detect smaller ones, either single or in groups, on any part of its surface, in consequence of the uncertainty induced by the total destruction of the dermal membranes. Some parts of

the surface exhibited stellate pittings very like those on the type specimen of *C. Mulleri*, but as these are only an accidental character, arising from contracting the tissues by drying, there is not much value in their stellate appearance. The form and proportion of the spicula and gemmules of all parts of the two sponges coincide; the only difference that I could note was that the hirsute spicula penetrating the crust of the Cape specimen were more numerous in a section examined than they appeared to be in a similar section from Dr. Fleming's British type specimen; an amount of difference that would probably be found to exist in different parts of the same specimen. I cannot, therefore, do otherwise than conclude, that they are the same species, notwithstanding the great differences that exist in their localities.

The history of this sponge presents a singular sequence of errors. In the first place, Muller is distinctly wrong in the designation of his species, which undoubtedly is *Alcyonium* of Ray and Linnaeus. Professor Jameson, perhaps misled by the stellate mantlings on the surface, believed the sponge from "Fulah and Unst" to be the same as Muller's specimen, and an Alcyonium. Dr. Fleming, at the time of the publication of his 'British Animals,' appears to believe it to be not an *Alcyonium*, but still identical with Muller's specimen, and accordingly gives it both a new generic and specific name. At last Johnston, seeing that it is not the type of a new genus, sinks both Dr. Fleming's generic and specific names, and correctly assigning the specimen to *Geodia*, renames it *Zetlandica*.

*Genus, PACHYMATISMA, Bowerbank.*

1. *PACHYMATISMA JOHNSTONIA, Bowerbank.*

*HALICHONDRIA JOHNSTONIA*, Trans. Mic. Soc. London, vol. i, p. 63,  
pl. vi.  
Johnston. Hist. Brit. Sponges, p. 198.

**Sponge.** Massive, sessile; surface smooth, undulating into ridges. Oscula simple, congregated on the elevations. Pores inconspicuous. Dermis crustular, filled with ovaria: dermal membrane pellucid, abundantly spiculous; spicula fusiformi-cylindrical, tuberculated, minute. Intermarginal cavities immersed in the dermal crust, separate, symmetrical, sub-cylindrical, valvular at proximal end. Connecting spicula, attenuate or cylindro-patento-ternate, radii variable in form and proportions. Skeleton, spicula cylindrical, variable in form and proportions. Spicula of sarcode attenuato-stellate, radii incipiently spinous, rarely fully spinous, or obtuse. Ovaria oval, depressed.

**Colour.**—Littoral specimens, light to dark slate gray. Deep sea specimens, pink or red. Capt. F. W. L. Thomas, R.N.

**Habitat.**—Rocks between high and low water mark, Torquay, Guliot Caves, South Coast of Ireland, Bowerbank; Orkney Islands, 35 fathoms, Capt. F. W. L. Thomas, R.N.; Wick, Scotland, C. W. Peach.

**Examined.**—In the live state.

I described this sponge in a paper read before the Microscopical Society of London, November 24, 1841, from specimens which I found attached to the rocks between high and low water marks, and designated it *Halichondria*

*Johnstonia*, but having subsequently consulted with my friend Dr. Johnston, of Berwick-on-Tweed, on the propriety of making it the type of a new genus, I afterwards named it *Pachymatisma*.

The outer surface of the crustular dermis is quite smooth; those parts of it in littoral specimens which are most exposed to the light, are of a dark gray colour, sometimes approaching black, while the marginal portions near the base are frequently of so light a gray as to be nearly white. The interior substance is of a dull yellow colour, firm in texture, and very much resembling the crum of bread in appearance.

The thickness of the dermal crust varies from a quarter to half a line. It is composed of ovaria, closely embedded in membranous structure; the greater portion of them appear to have ejected their prolific contents and become solid, but near the surface single specimens or small groups are filled with this substance. Intermixed with the ovaria, there are also frequently to be observed round siliceous molecules, of about the same diameter or rather less, than that of the adjoining spicula.

The dermal membrane is thin, and abounds with short, stout, fusiformi-cylindrical spicula, which are more or less irregularly tuberculated; they are also dispersed abundantly on the membranes throughout the whole of the crustular dermis, and are found occasionally in the sarcode of the interstitial membranes, lining the excurrent canals. Their average dimensions are, length  $\frac{1}{37}$ th in., diameter  $\frac{1}{500}$ th inch.

There is great variety in the form of the spicula, especially in those connecting the crustular dermis with the body of the sponge. The normal form of the connecting spicula appears to be attenuato-expando-ternate, the radii being more or less acutely terminated, and having a long attenuating shaft terminating acutely. In other cases they are cylindro-expando-ternate, and frequently very stout in their proportions; and between these two forms every imaginable variety and malformation may be found, the radii being frequently bifurcated or contorted to a great

extent. The ternate terminations are embedded in the inner surface of the crustular dermis, and the shaft passes into the body of the sponge beneath, at right angles to the surface, thus securely bracing the two parts of the sponge together, and forming areas for the valvular proximal terminations of the infermarginal cavities. The oscula frequently assume a linear arrangement on the elevated ridges of the surface. In the live state they are even with the surface of the sponge, and are furnished with a membranous veil, which apparently has the power of contraction, so as to entirely close the osculum at the will of the animal. In the dried condition they are frequently surrounded by a slightly elevated ring, arising from the contraction of the membranous veil in drying. They are very numerous, but rarely exceed the eighth of an inch in diameter.

In the living condition, the pores are not visible to the unassisted eye, but in the dried state they are very distinctly to be seen. They are very numerous, and occupy every part of the surface, excepting in the immediate vicinity of the oscula, near which they appear to be smaller than they are in the more distant portions of the space intervening between the groups of those organs. The normal form of the skeleton spicula is regularly cylindrical, with hemispherical termination of the same diameter as the shaft, but sometimes one or both of the terminations will be increased in diameter, so as to become sub-clavate, and at others, if it were not for the sub-hemispherical terminations of the lesser end, the form would be completely acuate; or we find the terminations sub-hemispherical and the shaft fusiform, to a considerable extent.

The arrangement of the interstitial membranes in the body of the sponge is strikingly similar to the mode of disposition of the membranous structure in the human lung when in a state of distension, and like it, they form the walls of continuous, irregular, and very much contorted cavities. When free of sarcode by maceration, they are thin, transparent, and destitute of spicula. In the living state the sarcode is in great profusion, and it is furnished

abundantly with stellate spicula, and sparingly with the minute and irregularly fusiform ones which abound in the dermis.

The stellate spicula are dispersed in considerable numbers in that substance ; they are remarkably large in comparison with those of *Geodia* ; an average-sized one measured  $\frac{1}{4}$  and of an inch between the extremities of the radii, which vary in number from three to ten, or twelve. The ovaria vary considerably in their proportions, those in a normal condition are from one and a half to two diameters in length ; an adult average-sized one measured, length  $\frac{1}{4}$  inch, diameter  $\frac{1}{3}$  rd inch. In their natural state, when viewed by direct light, they appear of the same colour as the surrounding tissues, but when viewed as transparent objects, the fertile ones present a dark central nucleus, varying considerably in size in different specimens, and in such ovaries the distal apices of the specula composing the shell are usually acute, or more or less rounded, while in the perfectly adult and fully developed ones, these ends of the spicula have a truncated angulated form, and the surface of the ovary has a smooth and even appearance, instead of being composed of sharp projecting points, as in the young and incompletely developed ones. After the discharge of their contents, the central cavity becomes filled up by a further development of the spicula inwards, and the process is also frequently continued in an outward direction, until the surface becomes tuberculated and distorted in a very remarkable manner.

*Genus—ECIONEMIA, Bowerbank.*

1. *Ecionemia compressa*, Bowerbank.
2. — *ponderosa*, Bowerbank.

*ECIONEMIA COMPRESSA, Bowerbank.*

Sponge. Elevated on a short compressed pedicel, mass much compressed, surface even, smooth. Oscula simple, dispersed, small. Pores inconspicuous. Dermal membrane abundantly spiculous; tension spicula acerate or inflato-acerate, entirely incipiently spined, rather slender, numerous; retentive spicula attenuato-stellate, large; and elongo-attenuato stellate, small, and very numerous. Connecting spicula attenuato-patento-ternate, radii long and rather slender, shaft rather short. Skeleton. Spicula acerate, rarely acuate, large, and long. Interstitial membranes abundantly spiculous; spicula the same as those of the dermal membrane.

*Colour.*—Light gray.

*Habitat.*—Shetland, Mr. C. W. Peach.

*Examined.*—In the dried state.

I am indebted to my friend Mr. Peach for this interesting specimen; the first British species I have seen of the genus. It was dredged by Mr. J. Gwyn Jeffrey, in 1864, and preserved for me by the donor, who accompanied the expedition. The sponge is in excellent preservation.

It is three and half inches in height; two and three quarters in breadth, within about an inch of the distal extremity, and its greatest thickness is about four lines; the height of the pedestal is three fourths of an inch, and

its breadth nearly the same; and there are two lateral lobes of the sponge, which each extend downwards to about half the length of the pedestal, their inner margins being nearly in contact with its thin edges.

The most distinctive characters in this species are those of the spicula of the dermal and interstitial membranes, and the tension spicula especially so; the incipient spination is common to them all, but the central inflation of the shaft is not equally prevalent; the greater number of them, perhaps, may be said to be deficient in that character, while in the other portion it is well developed, and always near the middle of the shaft. In many parts of the membranes, they are exceedingly numerous, and are always irregularly dispersed. The difference between the larger and the smaller stellate spicula in size is very considerable; the former are usually simply stellate or slightly elongated, while the latter appear always to be decidedly elongo-stellate. A satisfactory definition of these spicula requires a linear power of five or six hundred.

The connecting spicula are not very numerous, and are somewhat variable in size, their radii are often quite half the length of the shaft. I could not detect any recurvo-ternate spicula among them.

## 2. ECIONEMIA PONDEROSA, *Bowerbank.*

Sponge, Sessile, massive, lobate; surface smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane abundantly spiculous; tension spicula acerate, large, and long, dispersed; retentive spicula elongo-stellate, very numerous, minute; and also attenuato-stellate, small, few in number. Connecting spicula furcated attenuato-expando-ternate, furcations of the radii recurvate; shafts rather short. Skeleton, spicula very abundant, acerate, large, and long, irregularly disposed. Interstitial membranes; tension spicula same as those of the dermal membranes; and doliolate cylindrical spicula, both few in number;

retentive spicula same as those of the dermal membrane, few in number.

*Colour.*—Alive; dried, nut brown.

*Habitat.*—Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

The sponge in its present condition is three inches in height by about two inches in its average diameter; at about two thirds of its height, it divides into two large rudely conical lobes, terminating obtusely, each being about an inch in height. My friend the Rev. A. M. Norman informed me that when fresh from the sea it was very much larger than it is in its dried condition; that it was very ponderous and fleshy, and it was with great difficulty he succeeded in drying it, in the course of which operation it was exceedingly fetid. The dermis has a dense appearance in consequence of the abundance of the dark purple coloured sarcode with which it is lined, and the profusion of spicula embedded in it. The tension spicula are very numerous, irregularly disposed, and cross each other in every direction. They are rather less in diameter than those of the skeleton, but in every other respect they closely resemble them. The retentive spicula are remarkable from the paucity of spines at the middle of the shaft, so that in many instances they very closely simulate the rotulate form; they are exceedingly numerous and very minute, requiring a microscopic power of 700 or 800 linear to render them distinctly to the eye. The attenuo-stellate spicula, although small, are very much larger than the elongo-stellate ones. The connecting spicula vary considerably in size, but when fully developed they are large and strong, but rather short in the shaft; the recurvations of the furcations of the apices of the radii of the expando-ternate terminations are usually at the bases of the forks, and they are abruptly and strongly produced. When perfectly developed, these spicula are symmetrical in form, but they are subject to frequent malformations of the radii.

The interstitial membranes are very abundant, and the

spaces numerous and small; the acerate retentive spicula are few in number, the abundance of the skeleton ones rendering their presence to a great extent unnecessary, and a few doliolate cylindrical spicula were disposed on the membranes. On some portion of the membranes the elongo-stellate spicula were thinly dispersed, but in many parts they were entirely absent.

*Genus—POLYMASTIA, Bowerbank.*

SECTION \*\* Skeleton spicula, acuate.

1. *Polymastia ornata*, Bowerbank.
2. — *bulbosa*, Bowerbank.
3. — *robusta*, Bowerbank.
4. — *brevis*, Bowerbank.
5. — *spinula*, Bowerbank.
6. — *radiosa*, Bowerbank.

SECTION \*\*\* Skeleton spicula, spinulate.

7. *Polymastia mammillaris*, Bowerbank.

I. **POLYMASTIA ORNATA, Bowerbank.**

Sponge. Sessile (?). Base unknown; fistula single, large, and long. Surface abundantly but minutely hispid. Oscula congregated at the distal extremity. Pores inconspicuous. Dermal membrane pellucid, rather stout, abundantly furnished with short and stout acuate spicula, based on the external surface of the membranes; irregularly depressed, radiating in every direction. Skeleton: primary lines constructed of continuous large, compact, parallel, cylindrical fasciculi of spicula, dispersed at regular intervals, and extending from the base to the apex of the fistula, in a slightly spiral direction. Secondary or interstitial

skeleton formed of spicula of the same form and size as those of the primary fasciculi, irregularly disposed on the interstitial membranes. Spicula of skeleton acuate, large, and long.

*Colour.*—Alive, cream white.

*Habitat.*—About five miles off Whitby, Captain F. W. L. Thomas, R.N.

*Examined.*—In the dried state.

I received two specimens of this sponge from my friend Captain F. W. L. Thomas, R.N., of the Hydrographical Survey. They were dredged about five miles from the Yorkshire coast near Whitby, in thirty-five fathoms. He described them as “attenuated cylinders two or three inches long and a quarter of an inch in diameter, hollow, and flaccid, consisting only of a thin skin resembling white glove leather when recent.” Each of these specimens was about one and a half inches in length, and not quite three lines in diameter at the torn base, no part of the natural one being present; and they were compressed into a strap shaped form. On opening one of them from the proximal end to the apex, it presented a regular and very beautiful arrangement of the tissues. The inner surface is furnished with a single layer of large, symmetrical, parallel bundles of spicula which proceed from the base to the apex, in an elongated spiral direction, making about one turn between the two extremities. The fasciculi are united by a beautiful wide network of interlacing bundles of spicula. Between the inner and outer surface of the sponge there are irregular interstitial cavities either two or three deep, or a single one, which extends from the outer to the inner surface; thus approximating very closely to the principle of the structure in the parietes of the genus *Grantia*.

This beautiful and symmetrical arrangement of the tissues strikingly calls to mind the delicate and truly elegant sponge skeleton described by Professor Owen in the ‘Transactions of the Zoological Society,’ vol. iii, page 203, plate xiii, and designated by him *Euplectella asper-*

*gillum*. This species and others nearly allied to it in the Museum of the Jardin des Plantes, at Paris, designated *Alcyoncellum corbula*, each, like the sponge under consideration, consists of a single, large fistula, without any prominent basal mass, but is simply cemented at, or near its basal extremity to any foreign body against which it may happen to press during its growth.

The dermal membrane is translucent, but comparatively stout, and the external defensive spicula are irregularly dispersed on all parts of it, their bases being cemented on its outer surface, without any apparent reference to the secondary lines of the skeleton immediately beneath them, and they radiate from the surface in every possible direction. From the structure of the network of the skeleton of the external surface of the sponge, it naturally results that the pores are congregated in the areas of the large reticulations, and within their spaces one or two open pores were occasionally observed, but in the specimens under consideration they were of rather rare occurrence. In the dried specimen, the inhalent areas are depressed to the extent of more than the length of a defensive spiculum, and it is probable that this depression existed to a certain extent in the living state. In a fragment of a specimen of this species, sent to me by Mr. Barlee, and consisting of the extreme apex of the sponge, there are no indications of compression or collapse, the terminal portion being hemispherical, exhibiting a series of areas strongly indicative of a congregation of oscula, and very unlike those of the parietes of the general mass of the sponge.

The primary lines of the skeleton are situated at the inner surface of the sponge. They are rather distant from each other, and there are frequently more than one series of interstitial spaces intervening between them. The thickness between the outer and inner surfaces of the sponge is greater than that in *P. mammillaris*, and almost equal to that of *P. robusta*, although the general aspect of the sponge is more transparent, and apparently fragile than either of the fistular portions of those species.

**2. POLYMASTIA BULBOSA, Bowerbank.**

**Sponge.** Sessile, basal mass bulbous, apex of bulb terminating in a single fistula. Fistula gradually attenuating from the base to the bluntly conical apex. Surface even, minutely hispid. Oscula terminal on the cloacal fistula. Pores inconspicuous. Dermis of basal mass thin. Dermal membrane pellucid; dermis of the basal mass furnished abundantly with minute spinulate external defensive spicula, based on the external surface, irregularly dispersed. External defensive spicula of fistula same as those of basal mass; congregated more especially above the lines of the skeleton tissues. Skeleton. Fasciculi rather widely apart, loosely compacted; spicula acuate, large and long.

**Colour.**—Alive, and in spirit, cream white.

**Habitat.**—Shetland, Mr. C. W. Peach.

**Examined.**—In spirit, as it came from the sea.

This remarkable species was dredged at Shetland, in 1864. Its form is very much like that of a young onion just beginning to develop its bulb. The basal mass is seven lines high to the base of the fistula, and its greatest diameter is six lines. The terminal fistula is nine lines in length, and one and a half lines in width, near its base; it is in a closely collapsed state, but in opposite directions, in different parts of its length, and it gradually decreases in diameter from its base to its apex, terminating in a bluntly conical form. The base of the bulb is firmly cemented to the remains of a large *Balanus*, in company with a young specimen of *Dictyocylindrus hispidus*, the base of which spreads over a part of the shell, while that of *P. bulbosa* does not extend in the slightest degree beyond the point of its attachment.

The solitary fistula and the general aspect of the struc-

tures, at first led me to expect that it was a complete specimen of *P. ornatus*, but the characters of the spicula quickly dissipated that illusion. The delicacy and thin condition of the structures of the fistulae very closely assimilate them with those of *P. ornatus*, but while the latter has the external defensive spicula acuate, those of *P. bulbosa* are decidedly spinulate.

### 3. POLYMASTIA ROBUSTA, Bowerbank.

**Sponge.** Sessile, coating; surface even, smooth. Oscula terminal, congregated on numerous stout, long, mammæform, cloacal fistulae; apices of fistulae obtusely conical. Pores inconspicuous. Dermis coriaceous, armed abundantly with stout, ensiform spinulate spicula. Skeleton. Spicula super fusiformi-acuate, large and long. Interstitial membranes stout, compound, formed of layers of fibro-membranous tissue; fibres parallel, layers disposed most frequently at right angles to primary skeleton fasciculi, occasionally diagonally to them. Tension spicula acerate, very minute, rather few in number.

**Colour.**—Alive and dried, fawn-yellow.

**Habitat.**—Coast of Northumberland, Professor Wm. King, of Galway; three miles off Dunstanborough, Northumberland, Rev. A. M. Norman.

**Examined.**—In the dried state.

The best specimen I have seen of this fine species was presented to me by my friend, Professor King, of Queen's College, Galway. He informed me it was brought up by hook and line, in about 40 fathoms of water, about 40 miles from the Northumberland coast.

The sponge coats a surface of about nine square inches, and has thirty-nine of the tubular mammæform fistulae upon it, many of them exceeding an inch in length, but on

not one of them in the dried state is there any indication of a terminal aperture. Professor King told me, "that the colour when alive was the same as in the dead specimen. That it was stiff and rigid when alive, and that no apertures were visible on the mammae." In their dried condition they are strap-shaped by collapse; the largest of them are three lines in breadth at the base, and gradually tapering upward, terminate in obtuse cones.

At the base, within each of the fistulæ, there is a tolerably stout, contractile membranous diaphragm; in one case examined, the membrane was entirely closed, in another there was a circular opening in the middle of it, equal to about one fifth or one sixth of the whole diameter, and in a third case the orifice in the diaphragm was equal to about half its entire diameter. It is evident, therefore, that the animal has a perfect control over the action of the fistulæ, and as each of these organs are furnished with pores on all parts of their paricles, so they also have the power of independent inhalent and exhalent action, as well as the parent mass of the sponge. This power of regulating the vital action in one part of the sponge, independent of another part, is quite in accordance with a similar capability of suspension or alternation of action in the oscula of *Hymemacedon caruncula*, which I have described in my paper on the vitality of the Spongiadæ, published in the Reports of the British Association for 1856, page 438.

The anatomy of the fistulæ of this sponge, especially that of the fibro-membranous tissues, exhibits a high degree of organic structure, and indicates an amount and variety in the powers of action in these organs, unusual among the Spongiadæ. It is unnecessary to notice the unusually complex structures of these tissues at length, as they are sufficiently described at p. 100, in the first volume of this work. A specimen of this species, about two and a half inches long, and not exceeding nine lines in breadth, detached from the body on which it grew, was dredged three miles off Dunstanborough, Northumberland, and was sent to me for examination by the Rev. A. M. Norman, in

1865. It agrees in all its essential characters with the type specimen of the species.

#### 4. POLYMASTIA BREVIS, *Bowerbank.*

Sponge. Sessile, or slightly pedicelled, massively clavate, short, somewhat compressed, consisting of a single large fistula. Surface even, minutely but profusely hisped. Oscula and pores inconspicuous. Dermal membrane aspiculous. External defensive spicula acerate, or sub-fusiformi-acerate, short, very numerous; projected at about right angles through the dermal membrane for about one fifth of their length. Skeleton spicula. Super-fusiformi-acerate, large and long. Interstitial membranes; tension spicula, acerate, or sub-fusiformi-acerate, short, numerous, frequently fasciculated.

*Colour.*—Ochreous yellow, dried. Orange, when alive.

*Habitat.*—Shetland, 60 to 90 fathoms. Mr. Barlee, Rev. Mr. Norman, Mr. Peach.

*Examined.*—In the dried state.

I received from my late friend, Mr. Barlee, eleven specimens of this sponge. One was based on the shell of a living vermetus, the remainder were on small pebbles. The basal attachment exceeded in its diameter very little that of the smallest part of the ascending column of the sponge, which in most cases gradually increased in size, from the proximal to the distal extremity, which in some, presented a hemispherical form, while in others it assumed a compressed and truncated appearance. The height of the sponges varied from six to eight lines; the base being about two lines in diameter, and the distal extremity about three or four lines. When divided longitudinally, the parietes of the sponge did not exceed in the dried state, the fourth of a line in thickness at any part, and the internal cavity

extended the whole length of the sponge. The greater number of them were more or less in a compressed state, but in some there were strong indications that this was due rather to collapse than to natural form.

The Rev. A. M. Norman sent me four specimens of this species, two preserved in spirit, and two in glycerine, as they came from the sea, none of them presented the compressed appearance of the dried specimens, but the greatest diameter of three out of the four was oval rather than circular. At the distal termination of one of these specimens there was a mammaeformed projection of about half a line in height, that presented an appearance like that of a closed osculum; no other appearance of oscula were visible. The hispid character is rarely visible in the dried specimens with an inch lens, but when a portion of the sponge has been mounted in Canada balsam it becomes strikingly prominent, and the number of the spicula is so great as to completely obstruct the view of the dermal membrane through which they pass. Their direction is at very nearly right angles to its surface, for about one fifth of their length; their bases are intermixed with the transverse fasciculi of the skeleton beneath, and they penetrate the sponge to the extent of about half the thickness of its parietes.

In a specimen which I divided longitudinally, nearly the whole of the interior was empty; towards the base of the sponge there were a few irregularly disposed interstitial membranes, and on these the tension spicula were nearly all more or less fasciculated, but there was no regularity in the disposition of the fasciculi. In the sarcodæ of these membranes there were numerous small vesicles, filled with minute granules. The vesicles ranged in diameter from about once to twice the greatest diameter of a tension spiculum; but they were all of them evidently more or less contracted, from having been dried. I did not observe these vesicles in any other part of the interstitial membranes.

The number of the longitudinal fasciculi of the skeleton was from thirty-four to about forty, and their direction was

nearly in straight lines from the base to the apex of the sponge.

My friend, Mr. Barlee, states that in the living condition the sponge was of an orange colour, and semi-transparent, and that the reticulated structure was apparent through the surface. The interior was filled with a yellowish fluid, and the exterior slightly mucous.

Since the above was written, I have received two other specimens of this species. One, remarkable for its comparatively great height, the entire length being one and a half inch; the apex is obliquely truncated, and has two small mammaeform projections, one at each angle of the apex. The other specimen presents a singular variety of form and size. It is an inch in height, and although now compressed, is as broad as it is high; it has apparently in its living state been as nearly as possible globular. These specimens were sent to me by my friend Mr. Peach. They were dredged at Shetland, in 1864, by Mr. J. Gwyn Jeffreys.

##### 5. POLYMASTIA SPINULA, *Bowerbank.*

**Sponge.** Sessile, basal portion coating, thin; furnished with one or two, rarely three, long slender fistulæ.

Surface hispid. Oscula congregated, terminal on the fistulæ. Pores inconspicuous. Skeleton. Fistulæ strap-shaped, distal terminations more or less hemispherical; spicula of the primary fasciculi fusiform-acuate, long and stout. External defensive spicula of both basal mass and fistulæ spinulate, long and slender, more or less irregularly dispersed.

**Colour.**—Dried, cream white.

**Habitat.**—Moray Frith, Rev. Walter Gregor: Shetland, Mr. Barlee, Rev. A. M. Norman, and Mr. Peach.

**Examined.**—In the dried state.

The general aspect of this species is that of an incom-

pletely developed specimen of *P. mammillaris*, or of one in which the production of the fistulæ may have been supposed to have been arrested, and limited in number by adverse circumstances, but a closer study of the two species renders this idea inadmissible. The young of *P. mammillaris* always has a more or less thickened base, and the incipient fistulæ are short, thick, and conical. A young specimen from Mr. Barlee, dredged at Shetland, has the basal mass five lines in diameter and two lines thick, and it has three such incipient fistulæ on its surface, the longest not two lines in height, and no hispidation of the surface can be detected with an inch lens. The young fistulæ are developed precisely in the same manner on the circumference of a large specimen of the same species, two and a half inches in diameter, dredged at Orkney by Captain Thomas, and in several other specimens of intermediate stages of growth the same mode of development may be observed. We may, therefore, presume, that this is the normal mode of development of these organs in *P. mammillaris*. The same mode also obtains in *P. robusta*. The aspect presented by *P. spinularia* is very different. In a specimen sent to me by the Rev. Walter Gregor from the Moray Frith, seated in the hollow of a valve of a large water-worn Cardium, the base of the specimen is oval, four lines by three and not thicker than writing-paper. There has been two fistulæ produced, one has been broken off at the base, and the other is quite perfect; it is compressed in different directions in its course from base to apex, but at its widest part it does not exceed half a line in width, and is nine lines in length, and the hispidation of its surface is comparatively strongly produced; while an adult fistula of *P. mammillaris* measured one and a half lines wide and seven and a half lines long. In other specimens from Shetland, in the cabinet of the Rev. A. M. Norman, the length and breadth of the fistulæ are not so much out of proportion to those of *P. mammillaris*, but they all have but two or very rarely three fistulæ, and in other respects exhibit a close alliance with the specimens received from the Rev. Walter Gregor.

The general habit of this species is, therefore, strikingly

different from that of *P. mammillaris*. I deem it necessary to be thus particular in the description of differential characters as compared with *P. mammillaris*, as their structural characters appear to be so nearly allied, but a close scrutiny and comparison of the spicula of the two species exhibit sufficient differences to establish their separate identity on structural principles alone. Thus, the skeleton spicula of *P. mammillaris* are larger, and in every specimen examined the bases of the fusiformi-acuate spicula exhibit more or less tendency to enormous spinulation, while in those of *P. spinala* no such character is visible. The defensive spicula are as long as those of *P. mammillaris* but very much more slender, and the whole texture of the dermal surface more delicate and strongly hispid.

## 6. POLYMASTIA RADIOSA, *Bowerbank.*

**Sponge.** Sessile, adherent through its whole length; body circular or oval, furnished with a single mammaeform cloacal appendage; surface even, spiculous. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, furnished abundantly with small short fusiformi-spinulate spicula matted together, and also with large radiating groups of external defensive sub-fusiformi spinulate, or sub-fusiformi acuate spicula, large, and long. Skeleton. Longitudinal fasciculi few in number, large, dividing and anastomosing; spaces intervening, usually smaller than the diameter of the fasciculi; spicula acuate, occasionally sub-spinulate, large, and long.

**Colour.**—White.

**Habitat.**—Shetland and Peterhead, N. B., Mr. C. W. Peach.

**Examined.**—In the dried state.

I have received two specimens of this species from my friend Mr. C. W. Peach. One found at Peterhead, and the other dredged at Shetland, in 1864. The form and

habit of this little sponge is very singular. The shape is that of an oval battledore with a handle more or less long, adherent to the substance to which it is attached for its whole length, by one of its broad surfaces. The body of the sponge in both specimens is nearly of the same size and shape, but the mammaeform cloacal appendage in one is only half a line in length, while in the other it is half an inch; in other respects, they resemble each other very closely. The shorter of the two specimens is from Shetland and is in a finer state of preservation than the one from Peterhead. I have, therefore, selected it for description.

The length of the body is a line and a half, and its greatest breadth rather exceeding a line and a quarter; the cloacal appendage is half a line in length, and its medium breadth not quite a quarter of a line; its smallest diameter being at its apex, and its greatest breadth at the parts whence it springs from the body of the sponge. There are no indications on either specimen of the sponge ever having been in an erect position; on the contrary, both specimens are attached in precisely the same manner to the fragments of bivalve shells on which they were based, not by a few isolated points but by a close adherence of the whole surface. The entire thickness of the sponge does not exceed that of a sheet of writing-paper. Having carefully removed the specimens from the shells and mounted them in Canada balsam, in the cloacal appendage there appeared three large longitudinal fasciculi of spicula, the intervening spaces being almost equal in breadth to the diameter of the fasciculi, and their bases can be traced for a considerable depth in the body of the sponge. In the second specimen in which the cloacal appendage is very much longer, there are as many as five of these fasciculi which divide and anastomose repeatedly in their course to the apex of the cloacal appendage.

On the under side of the cloacal appendage there are numerous small spinulate spicula, crossing the large primary skeleton fasciculi at right angles to their axes in an irregularly matted manner; and the margins of the cloacal appendage are armed with numerous external defensive

spicula projected at about right angles, to the surface; they are sub-fusiformi, acuate, or sub-spinulate.

On the broad side, that was attached to the shell near its distal portion, the longitudinal primary fasciculi were no longer visible, but in place of them there were numerous detached fasciculi of large, fusiformi acuate and sub-spinulate spicula, immediately beneath the surface, irregularly crossing each other, but these fasciculi disappeared near the centre of the body of the sponge, at about the part where the primary longitudinal fasciculi were no longer to be seen; but, on the contrary direction, towards the basal portion of the sponge there is a manifest tendency to a disposition of the fasciculi in a radiant direction towards its outer margin. On the adherent surface of the sponge there appears to be but very few of the external defensive spicula developed, and those which were visible are in a recumbent position. The aspect of the exterior broad surface of the sponge is very different to that of the adherent one; here we have the whole surface bristling with the small external defensive spicula, and in addition to these there are large radiating clusters of long and stout sub-fusiformi-acuate, or sub-spinulate spicula. They spring from a closely compacted base and radiate thence at every possible angle, giving to the surface a very remarkable and beautiful appearance when examined in Canada balsam with a power of about 100 linear.

These radiating groups of spicula, and the profusion of external defensive ones, that exist in the smaller of the two specimens are nearly all absent in the larger specimen, which appears as if it had been denuded by abrasion. In the latter specimen, there are on the upper surface of the body of the sponge several well-produced oscula and a few smaller ones appear towards the distal portion of the cloacal appendage; but no such organs are to be found in the smaller of the two specimens.

7. POLYMASTIA MAMMILLARIS, *Bowerbank.*

*SPONGIA PENICILLUS, Montagu.*  
*HALICHONDRIA MAMMILLARIS, Johnston.*

Sponge. Massive, sessile. Surface even, hispid. Oscula terminal, congregated on slender mammæform cloacal fistulæ; rarely simple. Pores inconspicuous. Dermis of the basal mass sub-crustular. Dermal membrane pellucid, aspiculous. Dermis of the cloacal fistulæ furnished abundantly with radiating fasciculi of secondary external defensive spicula; spicula based on the external surface. Skeleton. Fistulæ numerous, strap-shaped, frequently truncated, or somewhat expanded at their distal terminations. Spicula of the primary fasciculi fusiformi-enormi-spinulate, rarely fusiformi-acuate, long and stout. External defensive spicula of basal mass, same as those of the skeleton. External defensive spicula of fistulæ fusiformi-spinulate, short and small, very numerous; congregated in radiating fasciculi, and based on the dermal membrane. Tension spicula fusiformi-spinulate, variable in size.

*Colour.*—Light ochreous yellow.

*Habitat.*—Larne Lough, Mr. Hyndman; Guernsey, Rev. A. M. Norman; Shetland, Mr. Barlee; Orkney Islands, Capt. F. W. L. Thomas, R.N.

*Examined.*—In the fresh and dried states.

I am indebted to my friend, Mr. George Hyndman, of Belfast, for two fine specimens of this species, each about two and a half inches in diameter, and about half an inch in thickness. Both have the appearance of having coated water-worn stones. The cloacal fistulæ are very abundant on both specimens; their average length is about six or seven lines, and their width a line and a half; they are compressed for the whole of their length, and the distal

extremities are often expanded laterally to the extent of half as much more as the average width of the tube. I am also indebted to the Rev. A. M. Norman, for the examination of a specimen of this sponge, which was dredged up on the coast of Guernsey, in the autumn of 1859. It is attached to a piece of an old oyster shell. It is irregularly conical in form, an inch and three-quarters in diameter at the base, and its greatest height seven lines. The hispid character of the surface is visible to the unassisted eye. There was one or two simple oscula, probably due to the destruction of as many fistulae while alive, the largest not exceeding half a line in diameter, the remainder of them, about sixteen in number, were all more or less mammæform, but apparently not in a fully developed condition, the tallest of them not exceeding two lines in height, and the greater portion were in a closely collapsed state. The fasciculi of skeleton spicula running longitudinally from base to apex of these cloacal appendages, do not appear to deviate from a straight line. The primary external defensive spicula of the basal mass of the sponge are continuations of the fasciculi of the skeleton, but the secondary series of external defensive spicula of the same mass have their bases beneath the dermal membrane, through which, in the dried state, they are projected for about one third of their length, and as they are exceedingly numerous, their presence gives a sub-crustular character to that portion of the dermal structure. This sub-crustular texture does not exist in the cloacal fistulæ. In these portions of the sponge there are no primary defensive spicula, but their surfaces are abundantly furnished with secondary defensive spicula, which are based on the external surface of the dermal membrane. They are mostly collected into radiating fasciculi, immediately above the transverse fasciculi of the skeleton, but a few of them spring singly from the surface of the dermal membrane in the spaces between the skeleton fasciculi. On many of the cloacal fistulæ they were so numerous as to render it very difficult to determine correctly their true positions.

The tension spicula of the interstitial membranes are of

the same form as those of the secondary series of external defensive ones, but they are usually much larger and longer. I have compared the specimens sent me by Mr. Hyndman, from Larne Lough, with the type of Montagu's *Spongia penicillus*, in the possession of Dr. Grant, and there is no difference between the two, either in external appearance or in structural characters. Montagu says:—"In drying, the tubes become compressed and a little arcuated, and all incline the same way;" and this is precisely their condition in the Larne Lough specimens, not only when dried, but when preserved in spirit fresh from the sea. No reasonable doubt therefore, remains, that the specimens dredged by Messrs. Thompson and Hyndman in Strangford Lough, in 1835, and sent to Dr. Johnston, and those dredged by Mr. Hyndman in Larne Lough, which were sent to me, are identical with Montagu's *Spongia penicillus*, and are therefore entitled to be considered as correct types of Johnston's *Halichondria mammillaris*. It is necessary to be thus particular in our recognition of the species, as a doubt might otherwise hereafter exist as to whether the sponge sent to me by Professor King, and designated by me *Polymastia robusta*, might not have been the original *Spongia mammillaris* of Johnston.

Montagu in describing *Spongia penitillus*, writes that:—"The interior substance of this species is precisely that of (*Tethea*) *lyncurium*, but instead of being orbicular, it spreads horizontally upon marine bodies, and shoots upwards from its surface cylindrical tubes, of nearly an inch in length, which have an opening at the apex." Dr. Johnston, probably on the authority of Montagu, repeats this assertion; but in the dried type specimen from Montagu's collection, there are no remains of such an open condition of the tubes as that described by him in the Wernerian Memoirs, and in no specimen of this or any other allied species of *Polymastia*, have I even been able to discover any such opening, or any distinct indication of such an opening, and I can only account for Montagu's assertion that such openings existed in any specimen in his possession, by the supposition, that the apices of the cloacal fistulæ had some

of them been 'broken off. This supposition is supported by the fact, that in the large species of the closely allied species, *Euplectella aspergillum*, Owen (*Alcyoncellum*, Quoy et Gaimard), no such large opening exists; the distal termination of the sponge being permanently closed by a strong network of spicula, in the areas of which the oscula are placed, the whole of them being congregated at the apex of the sponge.

Nor can I agree with Montagu, that the structure of the skeleton is similar to that of *Tethea lyncurium*, which consists of numerous slightly curved fasciculi of spicula, radiating from the base to all parts of the external surface of the sponge, while in *P. mammillaris* the skeleton of the basal mass consists of a plexus of contorted anastomosing fasciculi, with short bundles of skeleton spicula disposed on the inner surface of the dermal crust of the sponge, at about right angles to its plane, and which terminate acutely. In the adult sponges these fasciculi are continued through the dermal surface, and from the series of primary defensive spicula, and are exceedingly numerous in the Larne Lough specimens, while in the immature sponges they are very sparingly produced.

I received from Mr. Barlee, in June, 1856, two separate fistulæ of this species, neither of them had the basal termination. They were rather longer and larger than the fistulæ of the specimens from Larne Lough, and their distal terminations were more attenuate and rounded, but structurally they exhibited no difference whatever from the Irish and Guernsey specimens of the species, and I subsequently received from the same gentleman in June, 1858, four small specimens of this species, which he dredged up at Shetland; they were all more or less depressedly conical, and they varied in diameter at the base, from four lines to an inch. The smallest, four lines in diameter, had not a single mammilla on its surface, but the other three were amply supplied with them. They were all short, and had more of the characters of mammæ than of fistulæ, and the same peculiarities were observable in a specimen of about an inch in length by half an inch in width, that my friend,

Captain Thomas, of the 'Hydrographical Survey, sent me from Orkney. These peculiarities also agree with those which I have described as characterising the Rev. A. M. Norman's specimen from Guernsey.

None of these specimens had elongated fistular cloacal appendages, with a truncated distal termination, which are so abundant on the Larne Lough specimens, while in the latter a few of the short mammæform organs are found at the extreme margin of the sponge. In the structural characters of the young specimens we also find slight differences arising from immaturity. Thus the spicula in the young sponge are neither so long nor so stout as those of the mature ones, and the spinulate characters are not quite so fully developed as in those of the Larne Lough specimens, but in every other respect there is no essential structural difference. I have thought it important to mention these differences existing between the immature and the mature specimens, that hasty observers may not be led to believe them to be distinct species. The increment of the sponge is effected by a progressive extension of the dermal crust of the basal mass. On removing a small portion of this part, and mounting it in Canada balsam, it presented very much the same appearance as that of a small portion of an adult fistula. A series of parallel bundles of spicula in the direction of right angles to the margin of the sponge, connected by secondary skeleton fasciculi, in the areas of the reticulations of which the pores were seated.

*Genus—HALYPHYSEMA, Bowerbank.*

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1. *Halyphysema Tumanowiczii*, Bowerbank.
  2. — *ramulosa*, Bowerbank.

**1. HALYPHYSEMA TUMANOWICZII,\* Bowerbank.**

Sponge. Pyriform, pedicelled, base expanded, thick, turgid at the margin; pedicel gradually enlarging upwards, fistular, parietes very thin, surface smooth and even; distal extremity abundantly hispid. Oscula and pores inconspicuous. Dermal membrane thin and translucent. Skeleton. Membranous, with an incorporation of fragments of spicula of various sizes and forms, and of minute grains of sand.

*Colour.*—Alive; bluish white; milk white when dried.

*Habitat.*—Diamond Ground, off Hastings, Mr. Tumanowicz; Berwick Bay, Dr. Johnston; Cullercoats (?), Mr. Alder.

This species is remarkable as being the smallest known British sponge. It rarely exceeds a line in height. It is found based on the stems of small fuci and zoophytes, and frequently in considerable numbers. It varies but little from the normal form, but occasionally the pedicel is comparatively considerably elongated, and it is then often more or less contorted. The distal end is usually pyriform, but sometimes it is found nearly globular, and in one case it was projected at nearly right angles to the axis of the pedicel. When seated on a flat surface, the base of the sponge has much the same form as half of an orange

\* Pronounced Tumanovitehii.

divided at right angles to the axis of the fruit, and placed with the convex portion uppermost; and like the fruit it has a depression in the middle of the upper surface, from the centre of which springs the pedicel, which has its greatest contraction at its junction with the base of the sponge. from which part it increases gradually upwards, and finally enlarges into the pyriform distal termination. The attachment of the proximal end of the pedicel with the expanded base of the sponge is very singular. In some cases, I observed the end of the pedicel did not appear to be an open tube springing from the circular line of junction in the base of the sponge; but, on the contrary, it was contracted and apparently closed in a hemispherical form, and it looked as if it had been fixed into the base by having been, as it were, plugged into a previously existing hole on its summit, and the external and internal junction lines were sharp and angular. From this point upwards the pedicel gradually enlarges until it expands into the pyriform head. The whole sponge, the hassock-shaped base, as well as the pedicel and head, are hollow, and the thickness of the parietes is very inconsiderable.

The arrangement of the spicula of the skeleton in the base is decidedly irregularly reticular, and it is singular that the network in almost every case appears to be composed of fragments instead of perfect spicula.

In the pedicel, the spicula are dispersed, with very few exceptions, in lines parallel to the long axis of the sponge, and the short acerate spicula are more especially found in this part. Intermixed with the spicula of the pedicel there are frequently grains of sand and other extraneous matter embedded, apparently to increase its strength, and this intermixture more particularly occurs in the elongated ones. Occasionally, very stout and large spicula are found in the pedicel, and in one case an exceedingly large and stout triradiate one projected one of its rays at right angles from its axis, the other two running nearly parallel to the axial line of the pedicel. The head of the sponge is abundantly furnished with defensive spicula which radiate in all directions between lines in accordance with, or at right angles

to the axis of the sponge, but I have never observed them to assume a backward direction. These spicula are of great size in comparison with the dimensions of the sponge, frequently projecting beyond the surface of the head to the extent of one and a half, and sometimes twice the amount of its greatest diameter; and what is rather remarkable, it often occurs that the hemispherical heads of the acuate, and the globular heads of the spiculate spicula are the distal instead of the proximal portions of the spicula; and in one instance, among the projecting spicula, was an enormous triradiate one, having one ray based on the top of the head of the sponge, the other two being projected from its apex. I have been unable even with a high microscopical power to detect either oscula or pores. Nor have I succeeded in separating any portion of the dermal membrane from the sponge, but seen *in situ* it is evidently thin and translucent.

I first obtained this interesting little species from Mr. Tumanowicz, of Hastings, who informed me that he received it from the fishermen trawling off that coast, at the Diamond Ground, in about twenty-five fathoms; he has also found it on zoophytes, cast up on the beach after severe storms; we may, therefore, consider it as a deep sea species, from seven or eight to twenty-five fathoms. *Halecium Beanii* appears to be its favorite location, and on this zoophyte it is usually found in great abundance. He has also found it but in much less quantity on *Plumaria falcata*, and *cristata*, and *Sertularia, argentia, operculata*, and *abietina*; a few specimens only have been found on *Algae*, *Phyllophora rubens*, and *Plocamium coccineum*. When fresh from the sea, he states it is of a translucent bluish white colour. I have attached his name to it as an acknowledgment of the good service he has rendered to science by his indefatigable pursuit of marine natural history, and of the kind and liberal assistance that I have at all times received from him. I have also subsequently received specimens of this species from Mr. Alder, of Newcastle-on-Tyne, and from my kind friend Dr. Johnston, of Berwick-on-Tweed.

**2. HALYPHYSEMA RAMULOSA, Bowerbank.**

**Sponge.** Pedicelled, ramosæ; branching dichotomously; branches cylindrical, smooth, and even; distal termination sub-globose, hispid. Oscula and pores inconspicuous. Dermal membrane thin and translucent. **Skeleton.** Membranous, with an incorporation of fragments of spicula of various sizes and shapes, and of minute grains of sand.

**Colour.**—Cream white when dried.

**Habitat.**—Guernsey, Rev. A. M. Norman.

**Examined.**—In the dried state.

This little sponge was found by the Rev. A. M. Norman on a fragment of the skeleton of an old *Gorgonia verrucosa*, brought up by the dredge off Guernsey. The specimen does not exceed two lines in height and about the same in breadth, and in this space there are eight branches developed, they are all of the same diameter, and each terminates in a bulbous expansion, of a rather depressed form, from which numerous large spicula are projected forward at various angles. The parietes of the tubular body are very thin, and the outer and inner surfaces rarely exhibit any projecting parts of the heterogeneous materials composing it. In its construction it seems to have appropriated fine particles of sand and fragments of spicula indifferently. The fragments of spicula are very various, some are of large diameter, others very slender, but all seem to have undergone an approximation towards an arrangement, being disposed in the same plane, and they are frequently parallel to each other. There is also a method apparent in the selection and incorporation of the extraneous material of the skeleton that is very remarkable; the grains of sand all appear to be within a certain range in size, and beyond this all large ones seem to be rejected. In like manner, the fragments of spicula embedded in the parietes are all

of such a length as to be easily disposed of symmetrically, but in the armature of the distal bulb, the spicula appropriated are large and generally in perfect condition. The spinulate ones frequently have their bulbous bases outward, and the same reversals of position occurs with the acuate forms.

These peculiarities of position are strong evidence of their extraneous character. Their attachment to the heads of the sponge would otherwise lead us to suppose they were all really secreted by the animal, as their attached extremities are enveloped by the membranous and sarcodous tissues of the sponge, and these are continued around them for some distance upwards, while thin webs of dermal membrane connect the attached portion of the spicula with each other just as if they were the proper secreting organs of the spicula they envelop. These peculiarities of habit and structure are similar to those prevailing in *Dysidea* with the difference that one is productive of fibrous tissue, while, on the other, the development is tubular.

I could not detect any peculiarities in the basal portion of the sponge, such as exist in that of *H. Tumanowiczii*, and the sponge is larger in all its parts than in that species ; the branches were from two to three times the diameter, and the bulbous heads were in the proportion of four and a half to two, or two and a half the size of those of *H. Tumanowiczii*.

The acquisition of this species has thrown more light on the peculiarities of structure and habit of the genus *Halyphysema*, and it is a question whether in a future re-arrangement of the sub-orders these sponges should not be removed from Sub-order I to Sub-order II ; the essential base of the skeleton being membranous.

*Genus—CIOCALYPTA, Bowerbank.*1. *CIOCALYPTA PENICILLUS, Bowerbank.*

**Sponge.** Massive, sessile, composed of numerous closely-packed, attenuating, penicillate branches rising perpendicularly from a common base; branches gradually attenuating, occasionally bifurcating near the apex; apices rather obtuse, entirely closed. Oscula simple, small, dispersed; largest and most numerous near the base of the sponge, minute on the branches. Pores inconspicuous, dispersed, numerous. Dermal membrane smooth, abundantly spiculous, same as those of the skeleton, fasciculated, forming a strong irregular reticulation. Skeleton. Spicula fusiformi-acuate, stout, variable in size.

**Colour.**—Alive, light gray.

**Habitat.**—Diamond Trawling Ground, off Hastings.

**Examined.**—Alive.

This sponge is four inches in height, and three and a half inches in average diameter. It is nearly cylindrical and has much the form it would have attained had it been grown in a short half-pint drinking mug.

The penicillate branches originate on the basal membrane of the sponge, and are cemented to each other laterally for about two thirds of their height, and some of the marginal ones for nearly or quite the whole of their length, the greater portion of them attenuate gradually to their apices, but a few of them bifurcate irregularly at about half an inch from their summits. In the living condition their surface is slightly rugged or tuberculated, the impinging of the distal terminations of the pedicels, within causing this appearance, and this character is much exaggerated in

the dried sponge. In this state the dermal membrane presents very much the same beautifully reticulated appearance that is so striking a character in dried specimens of *Halichondria panicea*, and the size, number, and mode of disposition of the pores closely resemble those of *H. panicea*. I could find but one form of spiculum in this sponge, the fusiformi-acuate one; they varied considerably in size and diameter. This species is the only specimen of the genus I have yet seen. In treating of the generic character of this sponge, I have described the peculiarities of its structure so fully as to render any further description of them unnecessary. Since writing the above description I have obtained a second specimen from the same locality. The only notable difference is in size. The basal portion is irregular in form, two inches in length, and one and a half in breadth, and the average thickness is about half an inch. There are eighteen penicillate branches, the longest of them does not exceed an inch in height from the basal membrane of the sponge to its distal point, and its diameter over the base slightly exceeded two lines. It decreases gradually from the base to the apex, and terminates acutely. The whole of these small branches are of the same form. Towards the centre of the basal mass there are the remains of several very much larger branches which have been torn off slightly above the surface of the base of the sponge, the wounded terminations have been covered with dermal membrane, but the ends of the central columns within are distinctly to be seen through the new membrane.

There is a remarkable peculiarity in this specimen. All the small penicillate branches have the side nearest the outer margin of the sponge nearly smooth, while the opposite one abounds in mammæform tubercles from base to apex; this peculiarity of the outer surface is probably due to the abrasion and pressure from other bodies which were growing around it.

*Genus—TETHEA, Lamarck.*

## SECTION \* Skeleton spicula, acerate.

1. *Tethea cranius*, Lamarck.
2. —, *Collingsii*, Bowerbank.
3. —, *Schmidtii*, Bowerbank.

## SECTION \*\* Skeleton spicula, acuate.

4. *Tethea lyncurium*, Johnston.

## SECTION \*\*\* Skeleton spicula, spinulate.

5. *Tethea spinularia*, Bowerbank.

## 1. TETHEA CRANIUM, Lamarck.

## TETHEA CRANIUM, Johnston.

Sponge. Ovoid or subspherical, sessile. Surface even, strongly hispid. Dermal coat thick, abundantly furnished with short, stout, fusiformi-acerate spicula surrounding the large defensive fasciculi at various angles to their axes, also profusely furnished with minute sigmoid bihamate spicula, dispersed irregularly. Dermal membrane thin, pellucid. Oscula and pores inconspicuous. Spicula of the skeleton fusiformi-acerate, large and long. Defensive spicula external, collected in fasciculi; fusiformi-acerate, large, and long; fusiformi-porrecto-ternate, and a few fusiformi-recurvoternate very long and slender. Sarcodæ abundantly furnished with minute sigmoid-bihamate spicula. Gemmules internal, lenticula, surface smooth; very tough and strong; of two distinct sorts. The first furnished abundantly with slender fusiformi-acerate spicula radiating in fasciculi from the centre to near the surface of the gemmule. The second furnished abundantly with slender fusiformi-acerate; slender uni-

hamate attenuated ; and with short, slender porrecto-ternate spicula, mixed in fasciculi which cross each other irregularly.

*Colour.*—Alive, pallid green.

*Habitat.*—Island of Fulah, Jameson ; Haaf Banks, Shetland, Mr. Barlee, Mr. J. G. Jeffreys, Mr. Humphreys.

*Examined.*—In the living condition.

I obtained nearly three hundred specimens of this sponge from the Shetland deep sea fishermen through their agent Mr. Humphreys. The largest I have seen was somewhat depressed, and was nearly three inches in its greatest diameter. The smallest did not exceed a large pea in size. They vary in proportions from being nearly globular to about one and a half, their greatest diameter in height. The general description of this sponge by Dr. Johnston in his 'History of British Sponges,' p. 83, is very correct as far as it goes. The central nucleus spoken of by that author is simply the concentration of the proximal ends of the fasciculi near the centre of the sponge, and in elongated specimens it is continued upwards as the sponge increases in height. The fasciculi radiate from the short central axis in curves or straight lines, and apparently as often in one way as the other, and there is no difference in the form or size of the spicula from their origin to their termination, when they become intermixed with the defensive spicula of the surface. Their average size is  $\frac{1}{16}$ th inch long,  $\frac{1}{64}$ th inch largest diameter. The surface is even, but is pierced in all parts by stout bundles of defensive spicula which originate beneath the inner surface of the dermal crust, among the distal apices of the fasciculi of the skeleton, and project beyond the external surface frequently as much as  $\frac{1}{8}$ th of an inch. In the young specimens, these fasciculi consist principally of slender fusiformi-porrecto-ternate spicula, and their furcate apices form very beautiful objects for the microscope, but they are generally broken off in the older specimens. Interspersed with these there are usually a few long, stout, fusiformi-acerate ones, and a few slender but very long fusiformi-recurvo-ter-

nate spicula. The manner in which these fasciculi are strengthened and supported in their places is very remarkable, they are, as it were, each buttressed in its position by numerous comparatively short fusiformi-acerate spicula, which are based on the inner surface of the thick dermal coat of the sponge, and leaning from all parts around the fasciculus, their apices are concentrated around it, forming a most efficient conical buttress to it in its progress through the somewhat soft and yielding mass of the dermal crust of the sponge. These spicula do not reach the external surface of the sponge, but terminate in a cone about one third or one fourth the thickness of the dermal crust within its distal surface. Their dimensions are, length  $\frac{1}{50}$ th inch, greatest diameter  $\frac{1}{44}$ th inch.

Disposed in the surrounding sarcode there are an abundance of very minute contort bihamate spicula. These spicula are remarkably minute, an average-sized one which I measured was  $\frac{1}{2743}$ rd inch long, and  $\frac{1}{35000}$ th inch diameter, about the middle of the shaft. They are of a contort sigmoid form, and until a section of the sponge is immersed in Canada balsam they are not readily to be seen *in situ*.

Dr. Johnston, in page 82 of his 'History of the British Sponges,' says, "In the native species of *Tethea* there are neither pores nor oscula, and Mr. Edward Forbes informs me that in the living *T. cranium*, he did not observe any currents of water passing into or from the body. Adouin and Milne-Edwards, however, have seen their currents. When a *Tethea*, they tell us, is placed in a basin filled with sea water, and left for a considerable time perfectly still, we then see distinctly all the oscula agape, and we perceive also the currents which pass through them. But if the animal is irritated, or withdrawn for an instant from the water, the currents slacken or are altogether arrested, and the oscula contracting slowly and insensibly, become at last almost close." 'Hist. Nat. du Litt. de la France,' i, p. 78.

Although I carefully examined a considerable number of specimens, I could not detect either oscula or pores. The interior of the sponge is very close and solid, and the interstitial canals few in number. I cut a large specimen into

thin slices at right angles to the surface, but could not detect in the dermal crust anything in the shape of oscula or intermarginal cavities. At the same time, I believe MM. Adouin and Milne-Edwards's observations to be perfectly correct, and especially so as we are now aware that in *Hymeniacidon caruncula* and *Spongilla fluviatilis*, the oscula are opened and closed in precisely the manner described by those authors, and in the latter genus the pores have also the same power of opening at the will of the animal; and that when in a closed condition, no indication of their presence is visible in the dermal membrane. A portion of the spicula of the skeleton become external defensive ones, being intermixed with the defensive fasciculi. The true defensive spicula, the fusiformi-porrecto-ternate ones are exceedingly long and slender, and are frequently flexible near the attenuated base. An average sized specimen which I measured was  $\frac{1}{8}$ th inch in length and  $\frac{1}{115}$ th inch in its greatest diameter. The fusiformi-recurvo-ternate spicula which occasionally accompany the porrecto-ternate spicula average  $\frac{1}{12}$ th inch in length, and their greatest diameter was  $\frac{1}{230}$ th inch. The sarcodite is dense and semi-opaque, and abounds with the same minute sigmoid bihamate spicula that are found in the dermal crust.

There are two distinct sorts of gemmules in this sponge which are always grouped together. The first is rather the smaller of the two, and has a nucleus of slender curved fusiformi-acerate spicula; only the bases of the spicula cross each other at the centre of the gemmule, and the apices radiate in all directions towards the external surface, but do not in the fully-developed state of the gemmule project beyond it.

The second sort of gemmule is furnished with three distinct forms of spiculum. The first are like those of the gemmule described above, slender fusiformi-acerate, the second are attenuato-porrecto-ternate, the radii being given off from the apex, at about an angle of  $45^{\circ}$ ; and the third form is attenuato-bihamate or unihamate, and the hooked apices of this form are projected further than either of the other two forms, but do not pass beyond the

inner surface of the tough dermal envelope of the gemmule when in the adult state.

I have examined a great number of these gemmules, and could never find in the form first described any indication of either ternate or hamate spicula in any of them, and I am, therefore, satisfied that they are separate descriptions of gemmule, and that the first form is not a transition state from the young and undeveloped to the fully developed form; and in like manner I have closely observed the second form, and have always found it uniform in character, and furnished with the whole three forms of spicula that characterise it.

It is highly probable that this marked difference in structure is sexual, and from the more highly developed condition of the second or largest form that it is the female or prolific gemmule, but on this point we must at present be satisfied with conjecture only, as, although I have searched diligently for spermatozoa, in both forms of gemmule, and in the surrounding sarcode, I have not been able to detect any thing resembling them.

This occurrence of two distinct forms of gemmule in the same sponge is the first case of this singular fact that has come under my observation, and is the only indication of probable sexuality in the *Spongiadæ* that I have ever met with.

The short porrecto-ternate spicula of the gemmule are  $\frac{1}{30}$ th inch in length, and the unihamate ones  $\frac{1}{20}$ th inch in length.

When a gemmule is viewed in water by transmitted light, and a power of 150 linear, we find that it is thickly but indistinctly maculated.

## 2. TETHEA COLLINGSII, *Bowerbank.*

Sponge. Massive, sessile, depressed. Surface uneven and rugged. Oscula and pores inconspicuous. Dermis thick and dense; dermal membrane pellucid, furnished abundantly with minute acerate tension spicula; and, also, with attenuato-stellate retentive spicula, large and small, and also cylindro-stellate spicula, minute.

Connecting spicula attenuato-recurvo-patento-ternate ; radii short, stout, and abruptly recurved near their apices. Skelaton. Spicula fusiformi-acerate, stout. External defensive spicula fusiformi-acerate, short, and slender. Interstitial membranes. Tension spicula, acerate, slender ; retentive spicula, same as those of the dermal membrane, very abundant.

*Colour.*—Alive. External, somewhat green ; internally, light gray.

*Habitat.*—Guliot Caves, Sark, J. S. Bowerbank ; Round-stone Head, near Paignton, Torbay, Mr. Gosse ; Tremain Bay, Guernsey, fifteen fathoms, Rev. A. M. Norman.

*Examined.*—In the living state.

I received a portion of this sponge from the late Mrs. Buckland, who, I believe, obtained it from Mrs. Collings, the lady of the Seigneur of Sark ; and in 1860, I found the specimens I have described in the second of the Guliot Caves at Sark. I believe it to be of rare occurrence, and it was very difficult to distinguish it from the well covered surface of the rock to which it was strongly and broadly attached. The specimen I have is not above half its own diameter in height. It has a broad, flat, uneven surface, nearly two inches in diameter, with a deep cavity near its centre, and has much more of the aspect of a coating species of *Geodia* or *Pachymatisma* than that of the normal bulbous form of a *Tethya*.

The dermal coat is very dense, and in some parts it rather exceeded two lines in thickness. The connecting spicula are fasciculated, their bases converging to and uniting with the radial fasciculi of the skeleton where their distal terminations are radiated in all directions until they reach nearly the inner surface of the dermal membrane through which they rarely pass. A second and a more irregular series of ternate spicula exist immediately beneath the inner surface, and their recurved radii are frequently projected into the intermarginal cavities of the sponge, apparently effecting the office of defensive spicula in those

spaces. The whole of the connecting spicula are large and stout, with the radii very short, and abruptly bent backwards. In the canals which pass through the centre of the radii from base to apex there is frequently a small globular dilatation at about half their length, and occasionally the same canals assumed a somewhat moniliform character, but whether these minute peculiarities are accidental or specific it is difficult to say from a single specimen. The external defensive spicula are few in number, and not very regularly disposed. The stellate spicula abound most near the surface of the sponge, and especially the larger ones, and the membranes lining the large confluent intermarginal cavities are thickly studded with them; the three varieties of their form are intermixed near the surface, but in the deeper portions of the interstitial membranes the cylindro-stellate form prevails to a greater extent than the attenuato-stellate ones.

Since the above description was written I have received a small fragment of this species from my friend, Mr. Gosse, who "picked it from the under-side of a boulder at Roundstone Head, near Paignton, Torbay." It agrees in every structural character with the specimen I found at Sark.

*T. Collingsii* and *T. Schmidtii* closely resemble each other, both in external appearance and in structure, but they may, when mounted in Canada balsam, be readily separated by the difference in form of the external defensive spicula. In the former they are acerate; in the latter they are spinulate.

I have dedicated this species to Mrs. Collings, the lady of the Seigneur of Sark, to whose active researches in marine natural history we are indebted for our knowledge of the species.

### 3. TETHEA SCHMIDTII, *Bowerbank.*

Sponge. Massive, sessile, depressed. Surface minutely hispid. Oscula and pores inconspicuous. Dermis thick and dense. Dermal membrane abundantly spiculous; tension and external defensive spicula of the

same form spinulate, small, and slender; retentive spicula attenuato-stellate, rather large, with few radii; and minute cylindro-stellate, radii numerous. Skeleton. Fasciculi multisporulate; spicula fusiform-acerate, stout. Connecting spicula attenuato-recurvo-patento-ternate; radii short, stout, and abruptly recurved near their apices. External defensive spicula spinulate, small, and slender, variable in size, and often flexuous. Interstitial membranes abundantly supplied with the same forms of stellate spicula as those of the dermal membrane.

*Colour*.—Dried, dull ochreous yellow.

*Habitat*.—Guernsey, Mrs. Buckland; Herm, Rev. A. M. Norman.

*Examined*.—In the dried state.

I received the sponge under consideration from my late friend, Mrs. Buckland, who obtained it at Guernsey, with other British species, in 1857. The specimen is not entire, one end and a portion of one side having been cut away for examination. From its present aspect it does not appear to have exceeded an inch and a quarter in length by half an inch in breadth, and the same in height; and it seems to have been adherent by nearly the whole of its under surface. In its general aspect it closely resembles *T. Collingsii*.

The dermis is very thick and dense, in consequence of the profusion of the ternate terminations of the connecting spicula which are crowded over each other, forming a dense and strong crust to the sponge. The dermal membrane is thin and pellucid, and is abundantly furnished with spinulate tension spicula irregularly dispersed on its surface, interspersed with which there are both forms of the stellate retentive spicula, but not in any great number; while in the membranes of the intermarginal cavities, and in the interstitial membranes beneath, they are in profusion. The intermarginal cavities are disposed between the dermal membrane and the distal stratum of the ternate terminations of the connecting spicula, the fasciculi of which diverge

from their junctions with the skeleton fasciculi beneath, and meeting each other at their distal portions, form a uniform and continuous surface for the support of the intermarginal cayities. The external defensive spicula are rather numerous. In the dried condition of the sponge they are projected about half their length through the dermal membrane; the bulbous bases of these spicula are strongly produced, the shafts are often long and flexuous, and occasionally they are sub-fusiform. Although these spicula are so abundant in the dermal and intermarginal membranes, I could not detect them in the deeply seated interstitial ones, while the same tissues were crowded with both forms of stellate retentive spicula. The attenuato-stellate spicula are three or four times the diameter of the cylindro-stellate ones, and frequently have not more than five or six rays, while the latter have usually ten or twelve rays. This species, in its habit and structural peculiarities, closely resembles *T. Collingsii*. The skeleton and connecting spicula are of the same form in each, but those of the skeleton in *T. Schmidtii* are shorter, and less in diameter than those of *T. Collingsii*. The connecting spicula of the former are also shorter and stouter than in the latter species, but although thus less in size they have the ternate terminations much larger than in *T. Collingsii*. Thus the differential characters of the two species are not readily apparent to a hasty investigator, but by a more minute examination when mounted in Canada balsam, with the aid of a microscopical power of about one hundred linear, and by a close observation of the dermal spicular characters, the two species may be readily distinguished.

I have named this species after Dr. Oscar Schmidt, Professor of Zoology in the University of Gratz, who has done so much to advance our knowledge of the European species of sponges, by the publication of his valuable work on the sponges of the Adriatic. ('Die Spongien des Adriatischen Meeres.') A specimen of this species was found between two stones, at extreme low-water mark, by the Rev. A. M. Norman, 1865.

**4. TETHEA LYNCURIUM, Johnston.****ALCYONIUM LYNCURIUM, Linnaeus.**

**Sponge.** Massive, globular, sessile. Surface smooth and even. Oscula and pores inconspicuous. Dermis thick and coriaceous; furnished abundantly with large subsphero-stellate spicula with acutely conical radii, and near the external surface with numerous minute attenuato-stellate spicula. Skeleton. Spicula fusiformi-acuate, large and long, fasciculated into long stout bundles, which expand greatly at their distal corymbose terminations. Interstitial membranes furnished abundantly with long, slender, fusiformi-acerate tension spicula, dispersed in lines radiating from the centre of the sponge towards the inner surface of the dermis, and with numerous minute attenuato-stellate spicula. Gemmules. External, pullulating from near the base of the sponge; spicula, same forms as those of the parent.

**Colour.**—Alive, dull orange, to bright chrome yellow.

**Habitat.**—Plymouth, Mr. Thomas Howard Stewart; Torquay, Dr. Battersley and Mr. Gosse; Guernsey, Mrs. Buckland; Diamond Ground, off Hastings, J. S. Bowerbank; thirteen fathoms off Tremain Bay, Guernsey, Rev. A. M. Norman.

**Examined.**—In the living state.

The general external characters presented to the unassisted eye are accurately described by Dr. Johnston, in his 'History of British Sponges,' p. 85, but the warted appearances represented by Figs. 12, *a*, *b*, p. 87, are not strictly natural. This character has been produced by the corymbose terminations of the large radial skeleton fasciculi remaining stationary, while the surrounding coriaceous and

softer tissues of the sponge have been more or less contracted by either immersion in spirit or by drying.

In several living specimens which I have obtained immediately after they had been taken from the sea, the surface was smooth and not at all hispid, and the terminations of the radial fasciculi of the skeleton which form the wart-like projections in the specimens preserved in spirit or dried, were scarcely visible in the living ones.

The oscula are not usually visible, but in one specimen of the sponge sent to me by Dr. Battersley, enveloped in wet seaweeds, in a small jar, on immersing it in fresh sea-water, after about an hour I observed several oscula open near the distal end of the sponge; on probing one of them with a fine grass straw, the whole slowly closed, and I did not again succeed in seeing them open, but this event sufficiently indicated their locality. The diameter of the largest of the open oscula was rather exceeding a line.

The dermal crust of the sponge varies from one to two or two and a half lines in thickness. It appears to be thickest on the upper half of the animal, and especially at the extreme horizontal circumference, and the lower half is frequently not above half the thickness of the upper one. The large subsphero-stellate spicula are abundantly dispersed in the coriaceous substance of the dermis between the expanding terminations of the distal extremities of the skeleton fasciculi, and the small attenuato-stellate spicula are very abundant on the inner surface of the dermal membrane, and immediately beneath it, as if designed to especially protect it from the attacks of small predacious enemies which may have located themselves on its surface.

The large corymbose expansions of the distal terminations of the skeleton fasciculi are produced by the addition of a great number of fusiformi-acuate spicula, not above one third or half the size of the proper skeleton spicula; they are intermingled with the larger ones, without any apparent order, and their distal terminations are in accordance with those of the primary skeleton ones.

I am indebted to my late friend, Mr. Thomas Howard Stewart, of the Royal College of Surgeons, a promising

young naturalist, whom we have lost in the prime of his intellectual development, for my first knowledge of the mode of external development of the gemmules of this species. He found them pullulating from near the base of a specimen of the sponge which he obtained in the neighbourhood of Plymouth; and subsequently, on the 26th of January, 1862, I found six of the gemmules around the base of a living specimen which was dredged at the Diamond ground, off Hastings. The parent sponges and the gemmules in each case very closely resemble each other. Each of the gemmules was attached to the parent sponge by a fasciculus formed of several skeleton spicula; the bodies of the gemmules were quite separated from the Tethea, and each gemmule had its own distinct groups of radiating spicula. I have never succeeded in finding internal gemmules in any specimen of the sponge in which I have searched for them.

### 5. TETHEA SPINULARIA, *Bowerbank.*

Sponge. Massive. Surface even, minutely hispid. Oscula terminal, slightly elevated. Pores inconspicuous. Dermis coriaceous, thick. Dermal membrane pellucid, furnished at intervals with fasciculi of minute acerate spicula; spicula of the fasciculi very numerous, slightly curved, disposed parallel to each other, with the curves in accordance. Skeleton. Spicula subfusiformi-ovo-spinulate, long, and rather stout. External defensive spicula continuations of the skeleton fasciculi. Dermal defensive spicula fusiformi-ovo-spinulate, short and stout, disposed at right angles to surface, very numerous. Tension spicula sub-fusiformi ovo-spinulate; as large as those of the skeleton, irregularly dispersed, numerous; and also fusiformi-acerate, fasciculated like those of dermal membrane; fasciculi few in number.

*Colour.*—Dried, gray, with a tint of green.

*Habitat.*—Shetland, Rev. A. M. Norman.

*Examined.—In the dried state.*

I received six specimens and a fragment of this species from the Rev. A. M. Norman, who obtained them at Shetland. They were all nearly circular, and much depressed; they varied in diameter from three to seven lines, and the greatest height did not exceed three lines. In the middle of the upper surface of each there is one or more slightly elevated mammæ, and some of them presented rather indistinct indications of a closed osculum at their summits. The marginal portions of the specimens were covered with fine sand, which adhered strongly to the surface, but the mammæ, and immediately around them is clean, and free from it, probably by the action of the excurrent streams of water from the oscula. None of the specimens possessed the natural base, and the whole of them appeared as if they had been removed by a knife from the surface of a flat shell or stone. In the depressed form this species harmonises in habit with *T. Collingsii*. At the edge of the largest specimen a young *T. cranium*, scarcely exceeding a line in diameter, has fixed itself, as if to bear testimony to its Shetland locality.

The minute hispidation of the external surface is scarcely visible by the aid of a lens of one inch focus. When soaked in water the sponge appeared to be very firm and strong, and a section of the dermis in the dried condition presented very much the same texture and appearance as a slice from the margin of a thin white card. The terminations of the skeleton fasciculi forming the external defensive system, project about half or two thirds the length of a skeleton spiculum beyond the dermal surface, but those of the secondary system or dermal defensive spicula, rarely penetrate the dermal membrane. They are extremely numerous, and very closely packed together, their apices appearing immediately below the dermal membrane, and the bases of the largest and longest of them reaching to the inner surface of the coriaceous dermis. In the general character of form they closely resemble the skeleton spicula, but differ from them in being very much shorter, stouter, and more

fusiform in their proportions. The skeleton spicula are comparatively long and large, and slightly fusiform, and the form of their spinulation is very peculiar, the bulbous base being oviform, the distal portion being the smallest. This character appears to be a very constant one, and appertains to the dermal defensive spicula as well as to the skeleton ones.

The large tension spicula strengthen and support the interstitial tissue most effectively; they cross the skeleton fasciculi and each other in every possible direction, and are very numerous. The smaller description of tension spicula are very slender and delicate in their proportions, and are closely packed together in a fasciculus that rarely exceeds the length of one of the spicula. The fasciculi are irregularly dispersed on the interstitial membranes; two or three fasciculi are occasionally found together.

*Genus—HALICNEMIA, Bowerbank.*

**1. HALICNEMIA PATERA, Bowerbank.**

**Sponge.** Circular, concavo-convex, very thin; sessile, radiating from a small pebble imbedded in its centre. Upper surface convex, hispid by the projection of numerous bundles of long, slender, acerate defensive spicula; fasciculi radiating from the centre to the surface, and to the circumference, where they form a deep marginal fringe. Lower surface concave, smooth, and even. Oscula simple, dispersed on the lower surface, numerous and minute. Pores inconspicuous. Dermal membranes pellucid, spiculous; spicula very numerous, dispersed, fusiformi-acerate, entirely spined, subangulated, and frequently inflated at the middle.  
**Skeleton.** Spicula, attenuato-spinulate and fusiformi-spinulate, short and stout; and spinulate long and

large; spicula frequently with one or two extra inflations near the basal one. Interstitial membranes. Tension spicula abundant, the same in form as the dermal ones.

*Colour.*—Dried, light gray.

*Habitat.*—Shetland, Deep sea, Mr. Barlee, and Rev. A. M. Norman, 1868; Unst; Shetland, Mr. C. W. Peach, 1864.

*Examined.*—In the dried state.

The first specimens I received of this sponge were from my friend the late Mr. Barlee, who dredged them, I believe, in about 70 fathoms, off Shetland.

The greatest diameter of the large specimen is one inch, that of the smaller one three quarters of an inch. The height of the large specimen is about a quarter of an inch, and its greatest thickness about one third of a line. There is a considerable amount of extraneous matter deposited on the upper or convex surface of each of the sponges; and the concave, or underside of each, appears perfectly clear from such impurities. The only attachment in both of these specimens is to the small pebble imbedded in its centre, and the species is evidently not stationary, as in the larger specimen, with the concave surface downward, the central stone does not touch the plane surface on which its marginal fringe rests, and the under surface of the pebble in each is partially covered by a thin stratum of spongeous matter. The upper surface of the pebble in both is entirely covered by the dermal tissue of the sponge. This accordance in habit seems to indicate that the natural position is with the concave surface downward, and its freedom from impurities on that surface is the natural result of the action of the excurrent streams from the oscula which abound at the margin of the concave surface of the sponge. The habit of the sponge of including a small pebble in its centre, apparently as ballast, is very remarkable, and this is the only case in which there

is an indication of a natural tendency to locomotion belonging to the adult species that I have ever observed among the Spongiadæ.

The oscula were most numerous and largest near the margin of the under surface, and a few only were apparent on the upper surface of the smaller specimen.

The greater number of the pores were closed; a few that were open on the upper surface of the larger specimen were very minute when viewed with a power of one hundred linear by direct light.

The dermal membrane on both surfaces is crowded with its peculiar spicula. They are singular in their form, being fusiformi-acerate, not curved, as is usually the case with such spicula, but bent abruptly near the middle of the shaft, so as to form more or less of an angle, and at or near this spot there is generally an inflation of the shaft. The adult spicula are profusely and entirely spinous, but when not fully developed they are frequently quite smooth, or have the spines but very faintly indicated, but although not fully developed they are rarely without the inflation at or near the angle.

The skeleton spicula are remarkably large and very variable in form and proportions. The large, long, spinulate form, with one or two extra inflations, near the base of the shaft, are all disposed in one thin stratum, about midway between the upper and lower surfaces of the sponge, the bases being all towards the centre, and their points radiating towards the circumference. The short, stout, attenuato-spinulate and fusiformi-spinulate ones, with occasionally one extra inflation near the base, are mixed together, without order, in a thick stratum, which occupies the space between the stratum of long spinulate spicula and the lower surface of the sponge. The interval between the central stratum and the upper surface is occupied by large cavernous spaces which communicate by orifices in the interstitial membranes, which are abundantly furnished with tension spicula dispersed on their surfaces. Numerous hollow, irregular ridges or cones of dermal membrane are projected from the upper surface of

the sponge, and these are frequently terminated with a fasciculus of long, slender, acerate, defensive spicula. The marginal fringe of the sponge is formed by a continuation of the central stratum of large spinulate spicula slightly beyond the solid margin of the sponge, and by the addition of numerous long, acerate, defensive spicula. The interstitial membranes are thickly covered with sarcode, in which there are numerous minute granulated vesicles.

Since the above description was written I have received two specimens for examination from the Rev. A. M. Norman, who dredged them at Shetland in 1863. One was nine lines and the other seven lines in diameter and each had a small pebble imbedded in its centre, and in every other respect they closely resembled the specimens described. Two other specimens, dredged in the same locality, in 1864, were sent to me by my friend Mr. C. W. Peach; the diameter of one specimen was one inch, and of the other seven lines. The central pebble in neither of these specimens was visible but its presence was indicated by a slight projection near the middle of the concave surface of each, and on probing these spots with a sharp needle their impenetrability gave assurance of its presence. From the size of Mr. Peach's largest specimen being the same as the large one from Mr. Barlec; it is probable that the greatest diameter of this species rarely exceeds one inch.

*Genus—DICTYOCYLINDRUS, Bowerbank.*

## SECTION \* Skeleton spicula, acerate and acuate.

1. *Dictyocylindrus ventilabrum*, Bowerbank.
2. — *ramosus*, Bowerbank.
3. — *radiatus*, Bowerbank.

## SECTION \*\* Skeleton spicula, acuate.

4. *Dictyocylindrus Howsei*, Bowerbank.
5. — *hispidus*, Bowerbank.
6. — *aculeatus*, Bowerbank.
7. — *fascicularis*, Bowerbank.
8. — *virgultosus*, Bowerbank.

## SECTION \*\*\* Skeleton spicula, spinulate.

9. *Dictyocylindrus pumilus*, Bowerbank.

## SECTION \*\*\*\* Skeleton spicula, cylindrical.

10. *Dictyocylindrus stuporus*, Bowerbank.
11. — *rugosus*, Bowerbank.

**1. DICTYOCYLINDRUS VENTILABRUM, Bowerbank.**

**Sponge.** Pedicelled, rameous, fan-shaped; surface hispid; branches dividing dichotomously, rarely trichotomously. Oscula and pores inconspicuous. Skeleton. Spicula acuate and acerate, elongate, often flexuous. External defensive spicula attenuato-acuate, long and stout. Tension spicula fusiformi-acuate or acerate, slender. Internal defensive spicula attenuato-acuate, entirely but minutely spined.

**Colour.**—Alive, bright orange yellow. Buff yellow in the dried state.

*Habitat*.—British Channel, Brighton, Mr. Beckles.  
*Examined*.—In the dried state.

For this remarkable sponge I am indebted to the kindness and liberality of Mr. Samuel H. Beckles, of St. Leonards, who states, "I obtained it at Brighton; it was brought in by a fishing-boat, and is the only piece of the kind that I have ever seen."

The pedicel is barely an inch in height; at an inch and a half from the base it has divided into four primary branches; within an inch from their origin these primary branches each divide dichotomously, and this mode of division continues, with a single exception of one branch dividing trichotomously, so that at four inches from the base there are as many as twenty-two, all nearly in the same plane, assuming a fan-shaped series of branches, eight inches in height by about the same extent in width. The branches are cylindrical, or very slightly compressed; beside those produced by dichotomous division there are a few slender ones, thrown off irregularly, but laterally from the principal branches. In the dried condition of the sponge the hispid character is remarkably striking, the fasciculi of radiating spicula projecting from the central cylinder of the skeleton to the extent of at least one third of the whole diameter of the branch; but it is probable that in a living state their apices would be barely visible beyond the dermal membrane, no portion of which remains attached to the sponge, but portions of the sarcode and interstitial membranes are still found *in situ*, near the apices of the radiating spicula, in which there are numerous slender, fusiform-acuate tension spicula belonging to the membranes, collected in loose fasciculi, which each contain a considerable number of these spicula. The internal defensive spicula of the skeleton are not very numerous; they are slender in their proportions compared with the like description of spicula in other sponges, nor are the spines very strongly produced. Montagu's *Spongia ramosa*, described as "palmated and digitated round the top," and said to have been "first noticed in Mr. Boyer's cabinet of

British shells," appears to be the species so abundant near Hastings, and designated *Dictyocylindrus ramosus* in this work, while the sponge to which he alludes when he writes, "I have since taken a larger and more perfect specimen on the coast of Devon, measuring nearly five inches in height," is possibly the species now under consideration, but if the figure given by Montagu, plate viii, vol. ii, 'Wernerian Memoirs,' represents that sponge, it has evidently been in a very dilapidated condition; what remains of it would agree very well in size and form with the corresponding portion of Mr. Beckles' specimen, but in other respects the identification is far from complete; I have therefore thought it advisable to consider *D. ramosus* of this work as the type of Montagu's *Spongia ramosa*, and to give a distinct name to Mr. Beckles' specimen. I may also observe that *D. ramosus* has been obtained from the Brixham trawlers by my friend Mr. Thomas Ingall, exceeding nine inches in height.

Since the above was written, I have obtained a second specimen of this species from Mr. Henry Ridley, who states that it was taken by a trawler on the Rough Ground between Hastings and Brighton, early in May. When he received it, it was of a bright orange-yellow colour. This specimen does not exhibit the same fan-shaped outline, and numerous branches, that exist in the type specimen. It has the same short pedicel, and commences branching an inch from the base in the same manner, but it has only three branches; the first of them attains the height, including the basal portion, of ten and a quarter inches; the second branch divides dichotomously at about three inches from the base, and neither of these two exceed five and a half inches in height, and all are in the same plane, and the branches near their origin have the same description of slender lateral branches that are observable in the larger specimen.

The colour of Mr. Beckles' specimen was stated by the person who had the sponge from the fisherman to have been darker and more yellow before it was dried; it harmonises in colour, therefore, very closely with the specimen I obtained in the fresh state from Mr. Henry Ridley, of Hastings.

**2. DICTYOCYINDRUS RAMOSUS, Bowerbank.**

**SPONGIA RAMOSA.** Gerard's Herbal emended, 1577, No. 9.  
 — — — Montagu. Wern. Mem., vol. ii, p. 84, pl. viii.  
 — CRISTATA, Montagu.  
**HALICHONDRIA RAMOSA,** Johnston. Hist. British Sponges, p. 99.

**Sponge.** Arborecent, pedicelled, branches palmate, digitate, or irregular; cylindrical or compressed. Surface smooth and fleshy when alive. Oscula and pores inconspicuous. Dermal membrane pellucid, aspiculous. **Skeleton.** Spicula of axis sub-fusiformi-acuate, rarely cylindrical; radial spicula same as those of the axis, large and long. Internal defensive spicula; attenuato-acuate or sub-spinulate, numerous; spines minute. Tension spicula fusiformi acerate and acuate, slender, and often flexuous, numerous. Gemmules, membranous, aspiculous.

**Colour.**—Alive, yellow, orange, flesh-colour, pink or crimson. Light to dark brown in the dried state.

**Locality.**—South coast of England, rather common, Mr. Tumanowicz; Guernsey, and Polperro, Cornwall, Rev. A. M. Norman; Torquay, Mr. Thomas Ingall; Rye, Brighton, and Sark, J. S. Bowerbank.

**Examined.**—In the living state.

This species is subject to considerable variation in its form. I have obtained a great number of specimens from the neighbourhood of Hastings, where it is frequently found at high-water mark on the beach; very few of them exceed three inches in height, and they vary considerably in form and in the modes of the disposition of their branches. In some cases they ramify in every possible direction, while in others they assume a palmate or digitate arrangement. In the latter two forms of growth the branches are frequently much compressed.

My late friend Mr. Thomas Ingall obtained specimens of this species from the trawlers at Brixham, near Torquay, of very much greater size than any I have seen from Hastings and its neighbourhood, some of them having a height and breadth of nearly ten inches. The branches of these specimens were nearly all in the same plane; few in number, comparatively slender, and gradually attenuating to their distal extremities. Although differing so much in size, form, and proportions, from the Hastings' specimens, no organic differences could be detected.

Mr. Tumanowicz, of Hastings, has found this sponge alive after severe storms during the winter, and in this state he informs me that they are of a light orange-yellow colour, and that the lateral spicula rarely project beyond the external surface, excepting near the apex of the branch, and then to no great extent. Specimens subsequently found by the same gentleman were some of them deep crimson, with a slight shade of brown. When dried, this species presents a widely different aspect to that of the living specimens; in the latter state it is smooth and fleshy, in the former it is dark brown, and is profusely and strongly hispid.

The dermal membrane has no peculiar spicula, but a few of the tension spicula common to the whole of its internal membranes may be seen dispersed on its inner surface. The internal defensive spicula vary considerably in size; they are very numerous, and three or four of them are often grouped together on the skeleton tissues.

The only specimen in which I have found the gemmules was sent to me for examination by the Rev. A. M. Norman, who obtained it at Polperro, Cornwall.

There is little doubt that this species is the one designated *Spongia ramosa* by Gerard in his 'Herbal,' emended by Johnston, and by Montagu in the 'Wernerian Memoirs.' The description by the latter author of the manner in which it splits, and divides into fascicles, is correct as applied to a weather-worn specimen, but not to an unutiliated one.

The specimen in Montagu's collection of sponges, in the possession of Professor Grant, of University College, labelled

*S. cristata*, is a very young specimen of our *D. ramosus*, possessing none of the adult characters of that species, but agreeing with it precisely in the mode of arrangement, and in the form and proportion of the spicula of the skeleton, and of the internal defensive ones also. The form of the specimen has evidently misled Montagu, and induced him to believe it was of the same species as Ellis's *S. cristata*, which is certainly one of the many varieties of *Halichondria panicea* found abundantly on the reefs of rocks off Hastings that are submerged excepting at low water.

### 3. DICTYOCYLINDRUS RADIOSUS, *Bowerbank.*

Sponge. Pedicelled, branching dichotomously in nearly the same plane, compressed. Surface even, hispid. Oscula simple, dispersed, minute. Pores inconspicuous. Dermal membrane spiculous, tension spicula acerate, long, and extremely slender, often flexuous, dispersed or loosely fasciculated. External defensive spicula congregated in distinct and separate radiating fasciculi, nearly equidistant; spicula large and long. Skeleton. Axial spicula acerate and acuate, stout, and very long. Interstitial membrane spiculous; spicula same as those of the dermal membrane, rather numerous.

*Colour*.—Dried, nut-brown.

*Habitat*.—Vazon Bay, Guernsey, Mr. Cooper.

*Examined*.—In the dried state.

I am indebted to my friend the Rev. A. M. Norman, for my knowledge of this sponge, he received it, with other interesting specimens, from Mr. Cooper, of Guernsey, in 1865. It is two and a half inches high, and three inches in width; it has not its natural base. At seven lines above its present base it divides into two principal branches, and it continues to subdivide dichotomously at unequal distances to near the distal terminations of the branches,

which are all more or less furcate. All the branches are compressed, and they occupy nearly the same plane. The hispidation is strikingly characteristic in this sponge; the whole surface is furnished with numerous radiating fasciculi of large and long acuate spicula; each group contains from six to about ten spicula, diverging from each other at small angles, so that the whole combined present a regular series of defensive points at a slight distance beyond the dermal surface, while the bases of the groups are widely and distinctly separated from each other; the spicula are stouter and stronger than those of the skeleton. The axial column of the sponge is comparatively large; it extends very nearly to the dermal membrane. The skeleton spicula, acerate and acuate, are indiscriminately mixed in the structure, both are long and slender in proportion to their diameter, the acerate rather preponderating in number.

From its size, form, and general aspect, this species may readily be confounded with *D. stuposa* by a hasty observer, but the total absence of stellate spicula in the dermal membrane distinguishes it at once from that species. The general habit of *D. fascicularis*, and the species under consideration, are so like each other that those who are not acquainted with both species might be apt to confound the two, by the description of the external characters only, but here, again, a microscopical examination of either species will quickly relieve us from this chance of error.

#### 4. *Dictyocylindrus Howsei*, *Bowerbank*.

Sponge. Arborescent, pedicelled; branching dichotomously or trichotomously; branches slightly compressed, hispid ascendingly, surface smooth (?). Oscula and pores inconspicuous. Dermal membrane pellucid, aspicuous. Skeleton. Spicula sub-fusiform-acuate, often sub-spinulate, large. External defensive spicula same as those of skeleton, large and long. Tension spicula abundant. Acuate, rarely acerate, slender, and often flexuous; disposed in irregular, broad fasciculi.

Internal defensive spicula, entirely spined, sub-clavated attenuato-acuate, very few in number.

*Colour.*—Alive, scarlet ; dried, light brown.

*Habitat.*—Douglass Bay, Isle of Man; Strangford Lough, Ireland, Dr. Dickie.

I have seen but two specimens of this species, and neither of them were in a perfect state of preservation. I am indebted to Mr. Howse, of Newcastle, for my first knowledge of it. He kindly sent me for examination three small pieces, the largest not exceeding two inches in length. I subsequently received a specimen from Dr. Dickie, unfortunately also broken into pieces ; the largest fragment was about two inches long, branching dichotomously, and based on a valve of a small bivalve shell covering a considerable portion of its surface, and from this spreading base, four branches appear to have sprung.

The skeleton spicula vary considerably in size, many of them are very stout and long ; the fusiform character is but slightly developed, and about half of them exhibit more or less traces of spinulation ; the remainder are acuate, with occasionally an acerate one. The external defensive spicula are of the same form as those of the skeleton, but rather larger in size. Their position in the sponge is very characteristic of the species. I could not detect the internal defensive spicula *in situ* in either of the specimens, but among those obtained from boiling in nitric acid a portion of one of the fragments sent to me by Dr. Dickie, there were a few entirely spined sub-clavated, attenuato-acuate spicula, agreeing perfectly with each other in their characters, thus affording an indication of their presence in the sponge, although they could not be detected in the portions I examined.

I have dedicated this species to Mr. Howse of Newcastle-on-Tyne, in acknowledgment of the good service he has rendered to science in this and in numerous other instances.

**5. DICTYOCYLINDUS HISPIDUS, Bowerbank.**

**SPONGIA HISPIDA, Montagu.** Wern. Mem., vol. ii, pl. v, figs. 1 and 2.  
**HALICHONDRIA HISPIDA, Fleming and Johnston.**

**Sponge.** Pedieelled, arborescent; branches long and slender, dividing dichotomously, or trichotomously. Surface smooth, somewhat hispid. Oscula and pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton. Spicula acuate, large and long, rarely acerate. External defensive spicula same as those of the skeleton. Internal defensive spicula, attenuato-acuate or sub-spinulate, entirely spined; few in number, spines conical; acute and rather minute. Tension spicula acuate and acerate, long and very slender.

**Colour.**—Alive, yellow or orange.

**Habitat.**—Coast of Devonshire, Professor Quekett; Polperro, Cornwall, Rev. A. M. Norman; Diamond Trawling Ground, Hastings, J. S. Bowerbank.

**Examined.**—In the living or fresh state.

I have obtained several good specimens of this species from the Diamond Trawling Ground off Hastings, by the aid of Mr. H. Ridley. Montagu's description of the sponge in the dried condition is good as far as it goes. In this state it is remarkably hispid, but when fresh the sarcodes are so abundant that very few, comparatively, of the long external defensive spicula are projected beyond the dermal membrane. The specimen described by Montagu as being attached by its side, and branching at both ends, is evidently an abnormal form of attachment and growth. All that I have seen, rise, as he states, "perpendicular from the base," which is generally slightly expanded and firmly attached to a stone or shell. In the recent condition it is soft and flexible. The sarcodes are very abundant, and in some specimens it abounded in nucleated cells which

required a microscopic power of about 300 linear to define them well. I could not detect the oscula in any of the specimens I examined.

Among the specimens of British sponges formerly belonging to Colonel Montagu, but now in the possession of Professor Grant, there is a dwarf specimen of this species, but it is not the type one figured by Montagu in vol. ii, pl. 5, of the 'Wernerian Memoirs.'

## 6. *Dictyocylindrus aculeatus*, Bowerbank.

*HALICHONDRIATA ACULEATA*, Johnston.

**Sponge.** Sessile, rising from numerous small slightly expanded bases, branching and anastomosing. Surface uneven, abundantly furnished with large spicula projecting at nearly right angles to the axis. Oscula and pores inconspicuous. Dermal membrane pellucid, somewhat stout. Spicula. Of the skeleton; acuate, large, long and flexuous. Of the membranes; fusiformi-acerate and occasionally fusiformi-acuate; slender and flexuous. Internal defensive spicula attenuato-acuate, slightly but entirely spined, rare. Gemmules? Spherical or slightly oval, smooth, opaque, from once to twice the largest diameter of the skeleton spicula.

**Colour.**—Purple-gray when dried.

**Habitat.**—Scarborough, Mr. Bean..

**Examined.**—In the dried state.

This interesting little species was found at Scarborough, many years since, by my indefatigable friend, Mr. Bean. He had labelled it *Halichondria aculeata* in his cabinet. I have therefore adopted that appropriate specific name.

The height of the sponge does not exceed half an inch, and its numerous primary branches are based on small Balani; they are all nearly equal in height, and at their distal extremities there are occasionally branches thrown off in a horizontal direction, which seems to indicate that

the sponge had attained about its greatest altitude. In height and general habit it may readily be mistaken for *Hulichondria Hyndmanii*, but the branches do not terminate in a corymbose manner, as in that species. In the dry condition the projection of the surface spicula is nearly equal to the diameter of the primary branches. In the dried state the surface is irregularly and deeply excavated, but it is probable that this character would not be apparent in the living sponge.

The spicula of the skeleton are somewhat irregular in structure; the normal form is regularly acuate and flexuous, but occasionally they are sub-spinulate or sub-cylindrical; the distal termination is usually gradual and regular, but sometimes it is much attenuated and at others abrupt, and in the latter case it is often more or less mucronate. The internal defensive spicula are very few in number, and are not to be readily found, either *in situ* or after the separation of the spicula in boiling nitric acid; occasionally they are subspinulate.

The opaque gemmular bodies are dispersed irregularly amidst the tissues, sometimes appearing attached to the spicula, but more frequently slightly imbedded in the surface of the interstitial membranes; they have the appearance of a transparent integument, comparatively thick, enclosing an opaque, dark, steel-gray coloured nucleus. I could not discover any indication of spicula belonging to the integument, either *in situ* or after treatment with boiling nitric acid.

#### 7. DICTYOCYLINDRUS FASCICULARIS, *Bowerbank*.

Sponge. Arborescent, slender; branches cylindrical, dividing dichotomously. Surface smooth, aspiculous. Oscula and pores inconspicuous. Dermal membrane simple, translucent, aspiculous. Skeleton. Dense, abundantly spiculous; spicula attenuato-acuate, slender, often flexuous; furnished with distinct radiating fasciculi of external defensive spicula; spicula of the

fasciculi attenuato-acuate, stouter than those of the skeleton. Sarcode abundant, furnished sparingly with minute stellate spicula.

*Colour.*—Light amber when dried.

*Habitat.*—Hastings, Mr. Tumanowicz; Diamond Trawling Ground, Mr. H. Ridley; Guernsey, Miss Le Lievre; Vazon Bay, Guernsey, Mr. Cooper.

*Examined.*—In the dry state.

I received the first specimen of this sponge from Mr. Tumanowicz, of Hastings, who informed me that it was found on the beach in the neighbourhood.

The specimen is unfortunately imperfect, having been broken off, probably, about half an inch above its natural base. In its present condition it is two and a half inches long, and about a line in diameter. The principal stem is nearly straight, and at half an inch from the lower end it throws off a single curved branch rather less than an inch in length, from which a second very small branch is given off in like manner. The sponge is so similar in size and proportion to a slender specimen of *Dictyocylindrus stuposa*, dredged at the Orkney Islands by Mr. McAndrew, that at first sight I concluded that it must belong to that species, but on examining it with a lens of an inch focus the unusually corrugated and wasted appearance of the surface induced me to investigate it more closely. When viewed beneath a power of one hundred linear by direct light, each of the minute elevations is seen to be produced by the projection of a dense radiating bundle of spicula more or less enveloped in sarcode, thus presenting an appearance of a series of wart-like elevations on the surface of the dried specimen, but which would not, most probably, exist on the surface of the sponge when in the living and fully expanded condition. On examining a longitudinal section of the stem of the sponge through the centre of the axis, in water, as a transparent object, with a linear power of one hundred and sixty, the fasciculi of spicula were seen based on the cylindrical axis of the skeleton, and radiating thence through the thick coat of sarcode, to the surface, and to

a slight extent beyond it. Each of the fasciculi consists of a great number of spicula, and the radiation is frequently to such an extent as to form an angle of twenty or thirty degrees. In the spaces intervening between the fasciculi there is very rarely even a single spiculum to be seen passing from the axis of the sponge to its surface.

I could not separate the dermal membrane from the mass of sarcode beneath it, but it is evidently thin, simple and transparent, and apparently destitute of spicula.

The thick cylinder of sarcode surrounding the axial skeleton is uniform in its texture, and without any appearance of cavities or canals, and there are thinly and irregularly scattered through the whole of its substance, a few stellate spicula, with about six or eight attenuating radii. These spicula are very minute, not exceeding  $\frac{1}{800}$ th inch from point to point of the radii, and require a power of about 600 linear to exhibit them in a satisfactory manner.

The axial skeleton of this species is more complex in its structure than that of many of the allied species. The spicula of which it is composed are very slender, frequently flexuous and very numerous. Although at first sight this species may be readily confounded with slender specimens of *D. stuposa*, its anatomical differences readily distinguish it from that sponge.

I subsequently obtained from Mr. Henry Ridley, of Hastings, a much larger specimen of this sponge, it rather exceeded eight inches in height; like the first specimen, it had not the natural base, but the lower portion of the stem was two and a half lines in diameter. In every other character, except the size, it closely resembled the specimen I received from Mr. Tumanowicz. Although a more mature and much larger specimen than the type one and in a perfectly dry condition, I could not detect any protrusion of spicula through the dermal membrane. In this specimen, and in one obtained by the Rev. A. M. Norman from Mr. Cooper, of Guernsey, the whole of the branches are developed in the same plane; but in the specimen presented to Mr. Norman by Miss Le Lievre this is not the case, but the latter specimen has the appearance of having been dis-

torted in the course of its growth, and the branches have united where they have touched each other. The warted appearance of the surface is very strongly produced in Mr. Cooper's specimen, but in the other two referred to it is not nearly so apparent, in consequence of the peripheral fasciculi being so numerous and so close to each other as to almost obscure their fascicular character. Mr. Cooper's specimen has the natural base, which does not spread to a greater extent than about twice the diameter of the principal stem of the sponge. This species does not appear to attain a great size; the largest specimen I have seen is four and a half inches high and four inches broad, and the principal stem does not exceed one fifth of an inch in diameter.

### 8. *DICTYOCYLINDRUS VIRGULTOSUS*, *Bowerbank*.

**Sponge.** Sessile, virgultose; branches simple, ascending, very spinous. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton: spicula acuate or attenuato-cylindrical, large and long, rarely subclavate. External defensive spicula, primary series, acerate or fusiformi-acuate, short and slender, very numerous, fasciculated, divergent. Internal defensive spicula subclavate, attenuato-acuate, entirely spined, variable in size, occasionally very large and long; spines conical, minute.

**Colour.**—Dried, dark greenish-gray.

**Habitat.**—Shetland, Rev. A. M. Norman.

**Examined.**—In the dried state.

I received nine specimens of this sponge from the Rev. A. M. Norman; none of them exceeded an inch in height. The body of the sponge is irregularly massive and sessile; at about a quarter of an inch from the base it divides into a number of upright, straight, attenuating branches, which appear never to subdivide or dichotomise. Very few of

them exceed a line in diameter at the base, and they gradually attenuate to their distal terminations. When held up to the light they appear profusely spinous, the spicula projecting at right angles to the surface, frequently to the extent of two or three times the diameter of the part of the branch whence they spring. The branches all attain to nearly the same height, and their terminations are furnished with numerous large defensive spicula, which are projected in lines nearly in accordance with the axis of the branch.

From the appearance of the dried specimens it is probable that in the living condition the diameter of the branches would be at least twice that of their present condition. The secondary external defensive system consists of numerous fasciculi of comparatively small, slender, acutely terminated spicula, diverging from the base of the fasciculus, and spreading in every possible direction. The internal defensive spicula are very numerous, and are exceedingly various in size. Many of them are abruptly curved near the base, and the clavate expansion at the base of the greater portion of them is excentric to the axis of the spiculum.

## 9. DICTYOCYLINDRUS PUMILUS, *Bowerbank*.

Sponge. Sessile, or very slightly elevated on a massive pedicle; branching dichotomously or trichotomously; branches short, stout, obtusely terminated. Surface very slightly hispid in the living state. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton: spicula of axis sub-spinulate or acuate, rarely enorni-spinulate; radial spicula, same as those of the axis. Internal defensive spicula attenuato-acuate or sub-spinulate, entirely spined. Tension spicula acuate or acerate, long and slender.

*Colour*.—Alive, dark gray, with a tint of green.

*Habitat*.—Tenby, J. S. Bowerbank; Fowey, Cornwall, Mr. C. W. Peach; Jersey, Rev. A. M. Norman.

*Examined*.—In the living state.

I have seen but three good specimens of this sponge; the first I dredged in about seven fathoms, in the sound between Gilter Point and St. Margaret's Island, Tenby; the second I received from Mr. Peach, who obtained it at Fowey. They resemble each other very closely, but in the Tenby specimen the primary branches spring from a common base, closely adhering to a stone, while in Mr. Peach's specimen they originate at a very slight elevation above the base. The subdivisions follow each other at very short distances, and the terminations are frequently trichotomous. Neither of the specimens attained the height of two inches. The colour, when dry, of the Fowey specimen, is nearly that of a dark mahogany; that from Tenby is of a somewhat grayish hue; when fresh from the sea it was of a dark gray colour, with a slight tinge of green. The surface of the sponge, in the dried state, is abundantly and strongly hispid, and is so rugged and cavernous as to render it very difficult to distinguish the oscula, but they appear to be few in number and irregularly dispersed.

This sponge, at first sight, in the dried condition, might be readily mistaken for a stunted variety of *D. ramosa*, but in the living state the difference in colour and general aspect would readily distinguish them. The skeleton spicula of the two species also closely resemble each other in size, but the spinulate character of the bases of those of *D. pumilus* establishes the specific character with a much greater degree of certainty; a few of them are so slightly inflated at the base as to appear nearly purely acuate, but by far the greater number are distinctly more or less spinulate. On the contrary, the skeleton spicula of *D. ramosa*, whatever may be its variations in size or form, very rarely present any indications of inflation of the bases of those organs. The tension and internal defensive spicula of the two species closely resemble each other, but in the latter of the two forms those of *D. pumilus* are much smaller than those

of *D. ramosa*. In a small specimen of this species which I received from the Rev. A. M. Norman, who obtained it at Jersey, the tension spicula were exceedingly numerous, and were frequently grouped together in considerable numbers, in the form of large, irregular, flat fasciculi. The specimen was dredged off Jersey. It was attached to a dead shell of *Venus verrucosa*. It did not exceed an inch in height, but in other respects it closely resembled the specimen from Fowey.

#### 10. *Dictyocylindrus stuposus*, Bowerbank.

*Spongia stuposa*, var. *Damicornis*, Montagu.

— *Rigida*, Montagu.

*Halichondria cervicornis*, Johnston.

— *Rigida*, Johnston.

**Sponge.** Arborescent, pedicelled; branches slender, round, or compressed, dividing dichotomously and trichotomously; covered with long, scattered spicula projecting at right angles to the axis. Oscula and pores inconspicuous. Dermal membrane abundantly spiculous; spicula attenuato-sphero-stellate, radii acute, numerous. Skeleton: spicula of the axis cylindrical, rather short, and stout; radial spicula attenuato-acuate, large and long. Tension spicula acuate and acerate, long and slender, very numerous, frequently fasciculated.

**Colour.**—Light to dark brown, when dried.

**Habitat.**—Torbay, Mrs. Griffiths; Orkneys, Mr. M'Andrew.

**Examined.**—In the dried state.

The specimen presented to me by Mrs. Griffiths, of Torquay, labelled *Hal. stuposa*, is exceedingly like the figure represented by Montagu, 'Wern. Mem.', vol. ii, pl. iv, p. 79, in every respect. It differs essentially in its structure from the type specimen of *Halichondria cervicornis* of Dr. Johnston, figured in pl. v, fig. 1, p. 96, of his 'Hist. Brit.

Sponges,' or, indeed, from any of the specimens described by that author, and appears to be Montagu's *Spongia stuposa*, var. *damicornis*. There is good reason to believe that the specimens figured by Montagu in 'Wernerian Memoirs,' vol. ii, pl. iii, are only stunted varieties of his *Spongia hispida*, as very similar specimens of that sponge have been found at Hastings, and are in my possession; and there is also one in Montagu's collection of sponges in the possession of Dr. Grant, labelled *Spongia hispida*, which is quite as stunted as the upper of the two figures in pl. iii, vol. ii, of the 'Wern. Mem.,' while that which Montagu figures in pl. iv, and described as a variety, to "be called *damicornis*," is the better representative of *Spongia stuposa*. I have therefore thought it advisable so to designate this distinct and well-marked species *Dictyocylindrus stuposus*, and especially as the only other British species, *D. ramosus*, to which the name *stuposus* could with any propriety be applied, is undoubtedly *Spongia ramosa* of Gerard and other authors.

Among the sponges in the collection of Colonel Montagu in the possession of Professor Grant, of University College, there is the smaller of the type specimens figured in pl. xi, fig. 2, vol. ii, 'Wernerian Memoirs,' but the larger one, represented by fig. 1, is not there. On carefully examining the one represented by fig. 2 I found it to be a stunted specimen of the same author's *S. stuposa*, var. *damicornis*, represented in pl. iv of the same work, but the surface spicula which present so striking a feature in the latter specimen are nearly all absent in the former, which has evidently been much acted on by the sea before it was found. There is no difference in any of the structural characters between the two specimens, excepting that the minute sphero-stellate spicula of the membranes of *S. rigida*, Montagu, slightly exceed in size those of *S. stuposa* in my possession, a difference which is by no means uncommon in two specimens of undoubtedly the same species, and which frequently occurs in *Tethya lyncurium*. I am strongly inclined to believe that the larger of the two type specimens of *Sp. rigida* figured and described by Montagu is the one

to which he refers as being of an orange colour when fresh, and that it also was a dwarf specimen of his *S. stuposa*; if so, *S. rigida* of Montagu and *Halichondria rigida* of Johnston's 'British Sponges' are no longer species, but synonyms only.

The specimen of *D. stuposa* which I received from Mr. M'Andrew is in better condition than any one of the species that I have yet seen. The thickness of the sarcodous substance surrounding the skeleton is equal to about one third of the diameter of the latter, and in this fleshy coat comparatively very few spicula are disposed in a longitudinal direction. Very large attenuato-acuate spicula, as compared with the largest of the spicula of the skeleton, are projected from the cylindrical axis through the surrounding fleshy mass at irregular distances. In this specimen the sphaero-stellate spicula are in their normal position, immediately beneath the dermal membrane; they are exceedingly numerous, and are seldom more than twice their own diameter apart from each other, but there appears to be but a single layer of them, and it very rarely occurred that a specimen was found deeply imbedded in the fleshy mass, and I could not find any in the sarcode within the axis of the skeleton.

The tension spicula are very abundant. They are principally disposed around the axis in numerous irregular, flat fasciculi, lying usually in the direction of the axis of the sponge; a few of them only occurring at right angles to it; others are dispersed singly and irregularly amid the membranous tissues, and immediately beneath the dermal membrane.

The presence of the sphaero-stellate spicula in the fleshy substance of *H. stuposa*, Mont., distinguishes this species readily from all its congeners, and it should be remembered that these spicula are not usually perceptible under ordinary circumstances, but must be rendered so by boiling in nitric acid and mounting in Canada balsam. Montagu's figure, although roughly executed, is extremely characteristic, and the projection of the surface spicula in the dried specimen to a greater extent than the whole diameter of the axis of the sponge is by no means exaggerated. The axis, when

denuded of these spicula, has the appearance, to the unassisted eye, of woody structure, and it is very rigid and brittle.

I have not seen fresh specimens of this species, but it is highly probable that when alive the surface spicula would not project to anything like the same extent as represented in the dried condition.

### 11. DICTYOCYLINDRUS RUGOSUS, *Bowerbank*.

Sponge. Ramose, pedicelled, branching irregularly, short, thick, and fleshy. Surface rugose, slightly hispid. Oscula simple, large, dispersed, few in number. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton : axial spicula cylindrical, long, slender, very flexuous ; or sub-fusiformi-inequi-acerate, long and slender ; rarely acuate. Radial skeleton, fasciculated ; fasciculi compound ; spicula numerous, successive from base to apex, acuate, comparatively short and stout. External defensive spicula, terminal spicula of the radial fasciculi.

*Colour*.—Alive, light gray, with a tinge of yellow.

*Habitat*.—Orkney and Shetland, Captain Thomas, Mr. Barlee, Rev. A. M. Norman, and Mr. C. W. Peach.

*Examined*.—In the fresh state.

This sponge is by no means a rare species in the localities named. It rarely exceeds three inches in height, and the principal stem often exceeds half an inch in thickness. It usually begins to divide near its base, generally dichotomously, but sometimes trichotomously. The branches are frequently somewhat compressed, and they preserve the same diameter for nearly their whole length, terminating obtusely.

In the living or fresh state the central axis occupies about one third of the diameter of the sponge. The radial fasciculi have but few spicula at their bases, but they

increase considerably in number as they progress towards the surface, where a few of the terminal ones passing for a short distance through the dermal membrane act as external defensive spicula, rendering the surface, in the fresh state, very slightly hispid, but in the dried condition this character becomes, by contraction, exceedingly prominent.

Mr. Barlee dredged this species in sixty to seventy fathoms, about twenty-five miles off Lerwick, near the outer skerries; and I obtained about sixty or seventy specimens, preserved in salt and water, from the Shetland fishermen, who brought them up with hooks and lines while fishing in sixty or seventy fathoms at the Haaf Banks. In drying, this sponge assumes a deeper yellow colour than it has in the wet state.

#### *Genus—PHAKELLIA, Bowerbank.*

1. *Phakellia robusta*, Bowerbank.
2. — *ventilabrum*, Bowerbank.

#### **1. PHAKELLIA ROBUSTA, Bowerbank.**

Sponge. Fan-shaped, elevated on a short pedicle; distal margin attenuated to a sharp edge, surface smooth or very slightly hispid. Oscula simple, dispersed, numerous, and small. Pores inconspicuous. Dermal membrane aspiculous. Skeleton: axial column very slender; spicula acuate or acerate, large and long, flexuous; ramuli diffuse; spicula stout, rather short, acuate, occasionally acerate. Interstitial tension spicula very large and strong, rather numerous, mostly acerate, occasionally acuate, very flexuous, passing at various angles from one radial fasciculus to another.

*Colour.*—Ochreous yellow, when dried. :

*Habitat.*—Shetland, Mr. Peach.

*Examined.*—In the dried state.

This sponge was dredged at Shetland, in 1864, by Mr. J. Gwyn Jeffreys, and preserved for me by my friend Mr. Peach, who accompanied the expedition. It is the only specimen I have seen of the species. It is three inches in height, the same in breadth, and does not exceed four lines in thickness near the base, and gradually becoming thinner towards the distal extremity, where the margin is quite thin and sharp. The dermal membrane is to a great extent destroyed, but where it remains *in situ* it appears as if the surface had been smooth and even. In its present dried state it is slightly hispid, by the projection of the spicula of the distal extremities of the secondary ramuli of the skeleton. The dermal membrane has no proper spicula of its own, but in parts it is furnished with large acerate and acuate flexuous tension spicula, of the same description as those which occur so abundantly in the interstitial membranes.

The distal spicula of the secondary ramuli frequently diverge at their apices; approximating to form an external surface to the sponge, and it appears that it is where this divergence does not take place to the necessary extent that the dermal membrane is furnished with the large tension spicula as described above.

The axial columns of the primary radial fasciculi of the skeleton are very thin, the great size and strength of the spicula of which they are composed compensating for the want of numbers, and both this portion of the skeleton and the secondary ramuli are formed of spicula of a size greatly exceeding those of the corresponding parts in *P. ventilarium*. The spicula of the secondary ramuli, although quite as stout, are not more than about half the length of those of the primary ramuli of the skeleton. The interstitial spaces are very large, and their membranes are abundantly furnished with remarkably large and strong flexuous tension spicula, which frequently have their terminations imbedded in different secondary ramuli; they cross each other at

every imaginable angle, thus forming an irregular but strong connecting network of spicula between the neighbouring secondary ramuli.

## 2. PHAKELLIA VENTILABRUM, *Bowerbank.*

*HALICHONDRIA VENTILABRUM*, *Johnston.*

**Sponge.** Cyathiform or ventilabrumiform, elevated on a short pedicle; distal margin attenuated to a sharp edge. Surfaces smooth or somewhat rugose and excavated; minutely hispid. Oscula simple, dispersed, numerous and minute. Pores inconspicuous. Dermal membrane aspiculous. Skeleton: spicula of the axes cylindrical, long, slender, and very flexuous; of the ramuli acuate, slender, rather long, and frequently slightly flexuous. External defensive spicula same as those of the ramuli.

**Colour.**—Pale yellow, with a tint of green, preserved in strong salt and water while alive.

**Habitat.**—Haaf Banks, Shetland, Mr. Barlee and Mr. Humphreys; Loch Fine, Rev. A. M. Norman.

**Examined.**—Fresh and undried, as from the sea.

The description of the external characters of this sponge given by Dr. Fleming is very correct applied to dried specimens only, but it may be as well to remark that the difference between the fresh and the dried specimens is so great as to quite alter the specific characters derived from these sources. Thus, specimens which in the former condition have the surfaces smooth and imperforate, when dried become highly villous and present quite a reticulated and perforated appearance, in consequence of the contraction of the interstitial tissues, and the real oscula are undistinguishable amidst the numerous fractures arising from this cause. In young and well-preserved specimens, which have not been dried, the surface is usually smooth and even,

and the hispid character scarcely perceptible, but in old and well-worn specimens it is frequently rugose, and more or less excavated. The oscula are not readily detected in the fresh sponges; when apparent they appear as simple circular orifices, rather numerous, minute, and irregularly dispersed on all parts of the sponge. • The dermal and interstitial membranes appear entirely destitute of tension spicula; the former tissue is perforated by the distal terminations of the secondary ramuli, which form innumerable little radiating groups of defensive spicula, projecting through the membrane to the extent of about two thirds the length of a spiculum.

In the dried condition the primary cylindrical radii of the skeleton have very much the appearance of semi-decomposed ligneous fibre, and the exposure of the secondary ramuli by the contraction arising from drying gives the surfaces of the sponge a remarkably flocculent appearance, like that of a close thick coat of fine hair or fur, laid in every possible direction by immersion in water.

When sections of this sponge in a longitudinal direction are mounted in Canada balsam, and examined by transmitted light, with a power of about 150 linear, the primary ramifications of the skeleton are seen to consist of innumerable long and very flexuous spicula, loosely fasciculated together, as in the corresponding parts of a *Dictyocylindrus*, but the spicula in this sponge are very much more contorted in their flexuosity than in any species of *Dictyocylindrus* with which I am acquainted; and on the external parts of the cylinders these spicula are frequently so dispersed as to appear as if they were portions of threads which had been bound round the central fasciculus in an ascending direction, to keep the whole of the included spicula in position.

The secondary ramuli of the skeleton are singular in their structure. Their proximal terminations appear to have scarcely any connection with the primary cylinder whence they emanate; they commence with one, two, or three spicula loosely cemented together, but they accumulate spicula rapidly as they increase in length, dividing

continually, and pursuing an irregular undulating course to the surface, where the distal terminations expand to a very considerable extent. The total length of each ramulus is about equal to that of eight or ten of the spicula of which it is composed. The spicula of which the ramuli are formed have their apices always directed towards the surface of the sponge.

I received several of these sponges from my kind and liberal friend Mr. Barlee, and subsequently through his assistance I obtained between two and three hundred specimens from the deep-sea fishermen at the Haaf Banks at Shetland, through their agent Mr. Humphreys, and among these numerous specimens I found every imaginable variety of cup- and fan-like form that can be well conceived.

### *Genus—MICROCIONA, Bowerbank.*

#### SECTION \* Skeleton spicula acerate.

##### 1. *Microciona fictitia*, Bowerbank.

#### SECTION \*\* Skeleton spicula acuate.

2. *Microciona laevis*, Bowerbank.
3. — *fallax*, Bowerbank.
4. — *armata*, Bowerbank.
5. — *spinulenta*, Bowerbank.
6. — *carnosa*, Bowerbank.
7. — *ambigua*, Bowerbank.

#### SECTION \*\*\* Skeleton spicula spinulate.

##### 8. *Microciona atrasanguinea*, Bowerbank.

#### 1. *MICROCIONA FICTITIA*, Bowerbank.

Sponge. Parasitical on zoophytes or fuci; surface uneven,

pustulous. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane spiculous; spicula acerate, long, and slender, dispersed, numerous; retentive spicula equianchorate, tridentate, minute, short and stout, rather numerous. Skeleton: columns diffuse, long, and very irregular; spicula acerate, rather long and slender. External defensive spicula basally spined, attenuato-acuate or spinulate, long and rather slender, usually curved near the base. Internal defensive spicula entirely spined, attenuato-acuate, short; spines numerous and strongly produced. Interstitial membranes spiculous; tension and retentive spicula same as those of the dermal membrane, both numerous.

*Colour.*—Dried, brown with a tint of yellow.

*Habitat.*—Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

The specimen in course of description rather exceeds an inch and a quarter in length. It has entirely enveloped, apparently, the stem of a branching horny zoophyte; one portion of it is nearly cylindrical, with a diameter of rather more than two lines; the other is about the same thickness, but flat, and is rather more than five lines wide.

The general aspect of this sponge is so unlike that of other species of *Microciona* that it is very likely to deceive a hasty observer, and the confusion of its internal structures arising from their true bases being on the cylindrical surfaces of the zoophyte or fucus whence they spring, instead of on an expanded plane, increases the difficulties of identification; but a close examination of its structure in detail irresistibly leads to the conclusion that it is truly a *Microciona*.

The depressed pustulous character of the surface in the dried specimen is, with the aid of a lens of an inch focus, very characteristic, but it is probable that it is not apparent in the living sponge. Sometimes the pustules appear to be furnished with a closed osculum, but other oscula are seen

dispersed over the sponge without any connection with the pustular organs. The dermal membrane is furnished abundantly with tension spicula of the same form and size as those of the columns of the skeleton, intermixed with others of the same form, but very slender; and it has also a considerable number of retentive spicula intermixed with the tension ones. The general aspect of this organ is very much confused, in consequence of the terminations of the skeleton columns frequently curving in the direction of right angles to their long axes, and then spreading irregularly over the inner surface of the membrane, so as to produce the appearance of its being furnished with irregular flat fasciculi of tension spicula. This irregular habit of the skeleton columns is, to the best of my belief, peculiar to this species of *Microciona*. The skeleton columns are very irregular in their forms and directions; they are constructed of numerous spicula, disposed longitudinally, and are closely cemented together by keratode. The large external defensive spicula are based on their surfaces, whence they radiate at a great variety of angles, and not infrequently at right angles to their axes. The small internal defensive spicula are not very numerous, they are irregularly dispersed in all parts of the tissues, and are more frequently recumbent on the interstitial membranes than erect. The retentive spicula are small, but stoutly constructed; the lateral teeth are widely spread and slightly palmated. The interstitial membranes are numerous and strong, and abundantly spiculous, and exhibit on their surface, in a greater or less state of development, every form of spiculum that is found in the sponge, and the retentive spicula are especially numerous in some parts of them. Nearly the whole of the characters exhibited by the interstitial tissues are invisible until the section has been mounted in Canada balsam.

**2. MICROCIONA LÆVIS, Bowerbank.**

**Sponge.** Coating thin; surface even and smooth. Oscula simple, dispersed, minute. Pores inconspicuous. Dermal membrane spiculous; spicula attenuato-acerate, subclavate, long and slender, subfasciculate; and tricurvo-acerate, stout, central curve abrupt, dispersed, numerous. Skeleton: columns short and stout; spicula numerous, slightly divergent; attenuato-acuate, large and long. Internal defensive spicula attenuato-acuate, short, entirely spined; spines incipient, dispersed. Interstitial membranes, tension spicula tricurvo-acerate, stout, central curve abrupt, very numerous.

**Colour.**—Nut-brown, when dried.

**Habitat.**—Shetland, Mr. Barlee.

**Examined.**—In the dried state.

I am indebted to my late friend Mr. Barlee for my knowledge of this species. I received from him a single specimen, which covered the whole of the imperforate valve of a *Terebratula caput-serpentis*, and not quite an inch in length. In the dried condition the surface is even, but somewhat rough, but small portions from the parts in best preservation, when immersed in water, presented a smooth and even appearance, and I could not detect any projecting spicula.

The oscula are not readily determinable, but they appear to be simple and dispersed. The subclavate attenuato-acerate tension spicula of the dermal membrane are very long and slender. Sometimes they are loosely fasciculated. Its bundles do not assume any especial direction, but the bases of the spicula of the fasciculi appear to be always coincident. Many other separate spicula of the same form are irregularly dispersed on the inner surface of the dermal membrane. The tricurvo-

acerate spicula are also irregularly distributed. They vary considerably in length and diameter, but they all agree in the abrupt character of the middle curve.

The skeleton spicula are large, long, and usually perfectly smooth; occasionally, but rarely, an incipient spine may be detected at the base with a power of about 300 linear, but their occurrence is the exception rather than the rule.

The internal defensive spicula are short and rather slender. The spines are sometimes strongly developed at the base, but they always present an incipient appearance on the remaining portion of the spiculum. They are seated generally on the basal membrane, but a few are projected from the lower parts of the skeleton columns. In all parts of the interstitial fissures of the sponge the tricurvo-acerate tension spicula are dispersed abundantly.

I have designated this species *lævis*, in reference to the rather unusual smoothness of the skeleton spicula.

### 3. MICROCIONA FALLAX, *Bowerbank.*

**Sponge.** Coating, surface rough and uneven. Oscula simple, minute, dispersed. Pores inconspicuous. Dermal membrane pellucid, spiculous; spicula acuate, long, and slender, dispersed, very abundant. Skeleton: columns long, slender, and flexuous, occasionally branching; spicula acuate, basally spined; spines few and minute. Internal defensive spicula attenuato-acute, entirely spined, variable in size, and occasionally very long; spines very minute. Interstitial membranes, tension spicula same as those of the dermal membrane, comparatively few in number.

**Colour.**—Alive, bright crimson; dried, light brown, with a tint of red.

**Habitat.**—Diamond Ground, Hastings.

**Examined.**—In the dried state.

I received three specimens of this species from Mr.

Henry Ridley, of Hastings, who had them from one of the trawlers. The sponges, each completely covered the upper valve of a *Pecten opercularis*, and in thickness and general external characters closely resembled each other. The shells were uniformly coated with the sponge, which did not, in any part, exceed the eighth of an inch in thickness. The general anatomical structure, when examined microscopically, so closely resembles that of *Microciona carnosa* when in a young state, that it might readily be mistaken for that species. The slender, flexuous, and branching characters in the skeleton columns of each are alike, and it is only when we apply a microscopical power to the tissues when mounted in Canada balsam, that the difference in the characters of the spicula of the skeleton and the tension spicula, and the total absence of retentive spicula, which are so abundant in *M. carnosa*, becomes distinctly apparent.

The basal portions of the skeleton spicula are very sparingly spinous, and the spines are minute; they rarely extend beyond about two diameters of the spiculum above its hemispherical base. The tension spicula are very long and slender, and are frequently flexuous. The internal defensive spicula are very numerous and vary much in size; they are very abundant on the columns of the skeleton, especially towards their basal portions.

#### 4. MICROCIONA ARMATA, Bowerbank.

Sponge. Coating thin; surface minutely hispid. Oscula simple, minute. Pores inconspicuous. Dermal membrane spiculous, thin, pellucid. Tension spicula sub-clavate attenuato-acuate, long and slender, and anguloïd tricurvato-acerate; retentive spicula dentato-palmatate, equi-anchorate and bidentate, equi-anchorate very minute. Skeleton. Columns short and stout; spicula attenuato-acuate, basally spined, large and long. Internal defensive spicula attenuato-acuate, entirely spined, short and stout; spines of the base numerous,

short, and conical, occasionally curved; spines of the shaft very stout, long, and recurved, especially so towards the apex. Interstitial membranes; spicula same as those of the dermal membrane. Basal membrane abundantly furnished with internal defensive spicula. Gemmules spherical, membranous, aspiculous.

*Colour.*—Alive, blood-red; in the dried state, nut-brown.

*Habitat.*—Belfast Lough; Dr. Dickie; St. Catherine's Bay, Jersey, Rev. A. M. Norman.

*Examined.*—In the dried state.

This sponge coats the front of one of the valves of a common mussel-shell for two inches in length and about seven lines in breadth, and its greatest thickness is about two lines. The surface is rough, from the partial destruction of the cuticle and the exposure of a number of sinuous intermarginal canals. In its present condition its texture is rigid, and of a nut-brown colour. In consequence of the destruction of the dermal membrane to so great an extent, I have been unable to determine with certainty the characters of the oscula, but from the size and disposition of the intermarginal canals which conveyed the excurrent streams to them, it is probable they were small and dispersed over the thicker parts of the sponge. The dermal membrane is situated immediately above the terminations of the columns of the skeleton; small portions of its remains, about a line and a half in diameter, were pellucid, and abounded with its characteristic tension and retentive spicula. The spicula of the skeleton are singular, from having the bases furnished profusely with incipient spines, or tubercles for about the length of one diameter of the spiculum, beyond which the shaft is completely devoid of spines. The internal defensive spicula have their bases profusely furnished with large conical or recurved spines for about one diameter of the spiculum in length, and the remainder of the shaft is more sparingly, but still abundantly supplied with them, the spines becoming larger and

more recurved from about the middle to the distal extremity of the shaft. These spicula radiate from the columns of the skeleton at angles varying from ten to forty degrees towards the surface of the sponge; and they are also projected in considerable numbers from the basal membrane of the sponge in the intervals between the bases of the columns of the skeleton at right angles to the basal membrane. The columns of the skeleton are rarely connected with each other by membranes near their bases, but they are abundantly so connected near their apices; and in these membranes we find numerous fasciculi of the sub-clavated attenuato-acuate tension spicula, and a few of them are also disposed longitudinally in the membranes surrounding the columns of the skeleton. The anguloid tricurvato-acerate spicula are abundant in all parts of the membranous tissue. These spicula are singular in their character, the middle curves being very short and frequently nearly semicircular, while the terminal ones are long, but very slightly curved, so that the spiculum very nearly approaches the form of the letter V. The retentive spicula are very minute, and require a linear power of about 600 to render them distinctly.

I subsequently received two small specimens of this species, dredged off Jersey, in the summer of 1859, by the Rev. A. M. Norman. The sponges completely coated each of two specimens of *Murex corallinus*, the largest of which was seven lines in length, and the thickness of the sponge upon it was not more than one third of a line; but it was evidently a mature specimen, as there were a considerable number of gemmules imbedded amidst the tissues. They were spherical and membranous, and entirely destitute of spicula, and full of vesicular molecules. They varied in diameter from  $\frac{1}{150}$ th inch to  $\frac{1}{1500}$ th inch. My friend describes the sponges, in his letter to me, as, when alive, of "a very pretty blood-red.

**5. MICROCIONA SPINULENTA, Bowerbank.**

**Sponge.** Coating thin. Surface rugged and uneven. Oscula simple, minute, numerous. Pores inconspicuous. Dermal membrane spiculous; spicula cylindrical, sub-clavate, long and slender; dispersed or sub-fasciculate, numerous. Skeleton. Columns short and small; spicula attenuato-acuate, entirely spined; spines acutely conical, strong, and numerous. Internal defensive spicula same as those of the skeleton, few in number. Tension spicula of interstitial membranes same as those of dermal membrane. Retentive spicula bidentate inequi-anchorate and uniprocilcate and biprocilcate bihamate, dispersed, very minute and few in number.

**Colour.**—Dark brown when dried.

**Habitat.**—Squin Ground, Weymouth Bay, J. S. Bowerbank.

**Examined.**—In the dried state.

I dredged this species, in 1847, on the Squin Ground, in Weymouth Bay, near the wreck of the Abergavenny. It covers the shells of *Pecten opercularis* more or less, but always very thinly. It appears to be very common in that locality. I do not recollect the colour in the living state. In the dried condition it is a dark nut-brown. When examined by direct light with a two-inch combination, the surface presented a very rugged and uneven appearance, but in the living state it would probably be much more smooth and even. The oscula are small and numerous; the largest of them may be seen by the aid of a lens of two inches focus.

The dermal membrane is profusely furnished with tension spicula, which are dispersed, or very loosely and irregularly fasciculated. The spicula are slender, long, and usually

more or less clavate at their terminations, and are frequently somewhat flexuous.

The skeleton columns are short. They are composed of stout attenuato-acuate, entirely and strongly spined spicula well cemented together by keratode. The whole of the spicula do not spring from the basal membrane, a portion of them being successively produced in the course of the development of the skeleton, and the column frequently terminates with four or five of them radiating at various angles. The skeleton spicula vary considerably in size. One of the longest measured  $\frac{1}{143}$ rd inch in length, but the greater part of them range from  $\frac{1}{300}$ th to  $\frac{1}{250}$ th inch in length. The spination of the spicula is very abundant, and the spines strongly produced, especially at the base of the spiculum, where they frequently exceed in length half its greatest diameter. The retentive spicula in this species are very characteristic, but as they are both few in number and very minute, they are not readily detected, either *in situ*, after immersion in Canada balsam, or by the dissolution of a portion of the sponge in nitric acid. They require a microscopical power of about 600 linear to define them distinctly. The average length of the anchorate spicula is  $\frac{1}{150}$ th inch, while the unipocilate and bipocilate ones do not exceed  $\frac{1}{300}$ th inch in length. Each form prevails to about an equal extent, and the greater number of them appear to be seated on the basal membrane.

## 6. *MICROCIONA CARNOSA*, *Bowerbank*.

Sponge. Coating; surface even, smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, spiculous; spicula fusiformi-acerate, dispersed or loosely fasciculated, numerous. Skeleton. Columns long, slender, flexuous; abounding in spicula, frequently giving off single branches; spicula sub-attenuato-acuate, entirely spined; stout and long; spines conical. Internal defensive spicula; attenuato-acuate, entirely spined, shorter than those in the

skeleton, variable in size. Interstitial membranes. Tension spicula fusiformi-acerate, not very numerous; with a few skeleton and defensive ones intermixed. Retentive spicula bidentate angulated equi-anchorate, minute, uniform in size, very numerous.

*Colour.*—Alive, orange-red.

*Habitat.*—Sennen Cove, Land's End, Cornwall, and Diamond Ground, off Hastings, J. S. Bowerbank; Bantry Bay, Ireland, Guernsey and Polperro, Rev. A. M. Norman.

*Examined.*—In both the fresh and dried states.

I found this species adhering to the blocks of granite, somewhat protected from the full action of the sea near low water mark, under the point at the south side of Sennen Cove, near the Land's End, Cornwall, on the 6th of May.

The largest specimen was about two inches in diameter and half an inch in thickness, and of a deep orange-red colour. In the living condition the surface was smooth and even, but in the dried state corrugated or slightly mammillated. No oscula were visible in the living sponge.

The dermal membrane is pellucid, and is furnished abundantly with large fusiformi-acerate spicula, which are dispersed or loosely fasciculated. The skeleton columns are long, slender, and often flexuous, and frequently give off short, simple branches, which I have never observed to bifurcate, or to give off secondary branches, and they usually terminate like the primary columns in a cluster of defensive spicula, which radiate in every direction. The skeleton spicula are disposed on the surfaces of the columns and in accordance with the axis; they are longer than the defensive ones, and more inclined to be regularly acuate. The defensive spicula are decidedly attenuato-acuate, they vary considerably in size. They are very numerous, and are disposed on the column at all angles to its axis. One of these sponges is permeated by some small tubular zoophyte, which it has coated with its own tissues, and from these adopted columns defensive spicula are projected, in a similar manner to those of the columnar skeleton.

The interstitial membranes are abundant, apparently strong, and are often sinuous in their course. They are furnished with the same description of fusiformi-acerate tension spicula as those of the dermal membrane, but very much more sparingly, and a few of the skeleton or defensive spicula are occasionally embedded amongst them. The retentive spicula are very abundantly dispersed over the surfaces of the interstitial membrane as well as on the inner one of the dermal membrane; they are minute, and very uniform in size. The sarcode is abundant on the interstitial membranes, and completely obscures the retentive spicula until a thin section of the sponge is mounted in Canada balsam.

The general aspect of this species, both in the living and dried states, so closely resembles that of *Hymemacedon caruncula* that I fully believed it to be that species until I had examined it microscopically.

I subsequently received a specimen of this sponge from the Rev. A. M. Norman. It was collected at Bantry Bay, and coated a group of shells of a vermetus, nearly two inches in length by one in breadth. The surface of the sponge is very much more rugged and uneven than that from Cornwall, arising probably from immaturity and the peculiarities of its locality. In all its anatomical details it agreed perfectly with the Cornish specimen. Mr. Norman's specimens were found "on a rock situated about the middle of the entrance of Glengarriffe Bay, extreme low water mark."

In January, 1865, I received a specimen, at Hastings, from the Diamond Ground, oval in form, three and a half inches long, one and a half inches wide, half an inch thick; when alive it was of a full red flesh colour, and the surface with very slight inequalities, but when dried it was exceedingly rugged and mammillated by the projection of the terminations of the columns of the skeleton.

This species may be readily mistaken for *M. fallax*, at the first view, but when mounted in Canada balsam, and examined with a power of about 400 linear, the abundance of its retentive spicula, and the differences existing in the structure of its skeleton and tension spicula, render the

discrimination of the two species comparatively easy and satisfactory.

### 7. MICROCIONA AMBIGUA, *Bowerbank.*

Sponge. Coating; surface even, slightly hispid. Oscula simple, dispersed, minute. Pores inconspicuous. Dermal membrane, spiculous; spicula acerate, long and slender; sub-fasciculated. Skeleton. Columns very short, and indistinctly produced; spicula attenuato-acuate, basally spined, large and long, irregular in size. Internal and defensive spicula attenuato-acuate, entirely spined; short and stout. Interstitial membranes; tension spicula cylindrical, entirely spined, frequently sub-attenuated, distorted, and curved considerably; very numerous. Retentive spicula angulated bidentate equi-anchorate; and, rarely, palmated equi-anchorate.

*Colour.*—Wet condition, light ochreous yellow; dried, light brown.

*Habitat.*—Shetland.

*Examined.*—Fresh from salt-and-water pickle, and in the dried state.

The specimen described above coated the expanded extremity of one of the valves of a large shell of *Pinna ingens* (?). It covers a space of seven and a half by six and a half inches, and in no part exceeds a line in thickness. On the smooth portions of the shell the surface of the sponge is even, and in the wet condition no oscula could be detected by the aid of a lens of an inch focus; but in the dried state several were apparent in the mature portions of the sponge. In the young and progressing margins of the sponge the extreme edge appears as a thin film of gelatinoid matter, in which a few tension spicula are irregularly dispersed; within this marginal portion the

tissue becomes thicker, and the tension spicula numerous and more approaching regularity of disposition, but there is no appearance of the columnar skeleton and its peculiar spicula; so that a young and immature specimen might readily be mistaken for a species of a different genus; but in the mature sponge this mistake cannot readily occur. Although the keratose columns of the skeleton are but very slightly produced, their fasciculi of large and characteristic spicula render such an error very improbable. The skeleton columns, generally speaking, are but very indistinctly produced; the keratose portion frequently forming on the basal membrane a slight elevation only, from amidst which one or more of the large skeleton spicula sprung; or it is represented by the cementing keratode that binds them together for a short distance in their progress upward; but the peculiarities of their size, form, and mode of arrangement will always indicate, unmistakeably, the genus to which this species belongs.

The dermal membrane is profusely furnished with its peculiar spicula, which are more or less fasciculated, and these bundles extend more especially from group to group of the skeleton spicula, which they appear to serve, to maintain, and support in their respective positions. One third or half of the distal extremities of the skeleton spicula are frequently projected through the dermal membrane, thus performing the office of external defensive spicula as well as of skeleton ones.

The internal defensive spicula nearly all spring from the basal membrane of the sponge. They are generally grouped around the base of the skeleton columns, but they also appear independent and isolated, and occasionally they are based about midway on the side of the skeleton columns. They rarely exceed a fourth of the length of a fully developed skeleton spiculum, and are always entirely spined.

The interstitial membranes are abundantly supplied with tension spicula, especially so the basal membrane of the sponge, on which they are so thickly dispersed as to simulate the appearance of a secondary skeleton; they are rather shorter than the internal defensive ones, or about a fifth of

the length of an average size of skeleton spiculum, about half a line.

The skeleton spicula occasionally, although rarely, attain the length of a line, and this extension of the ordinary length usually obtains when the skeleton column is represented by a single spiculum, which has its base in the basal membrane and its apex projected through the dermal one.

There is a paucity of keratode, and an immaturity in the production of the skeleton columns, which appears to indicate a young condition of the sponge; this is assuredly the case in the marginal portions, and notwithstanding the large area of its surface I am strongly inclined to believe that no part of it is in a fully developed condition, and that hereafter, in older specimens, the skeleton columns will be found in a much more satisfactory state of development.

## 8. MICROCIONA ATRASANGUINEA, *Bowerbank*.

Sponge. Coating thin, surface minutely hispid. Oscula simple, minute, numerous. Pores inconspicuous. Dermal membrane pellucid, thin, spiculous; tension spicula acuate or sub-clavate, long and slender, and a few tricurvato-acerate; retentive spicula bidentate, equi-anchorate, few in number. Skeleton columns short and stout; spicula of the body of the column fusiformi-attenuato-sub-spinulate, short and rather stout; of the terminations long and large, curved outwardly, projected through the dermal membrane for half or two thirds their length, as external defences. Internal defensive spicula sub-spinulo-acuate, entirely spined, few in number. Interstitial membranes rare; spicula same as those of dermal membrane, few in number.

*Colour.*—Alive, dark blood-red; dried, brown or dirty green.

*Habitat.*—St. Katherine's Cave, Tenby. Rocks off Hastings at low water; Guliot Caves, Sark; Sennen Cove, Land's End, Cornwall, J. S. Bowerbank.

*Examined.*—In the living state.

This sponge occurs abundantly in the small cave about the middle of the north side of St. Katherine's Island, Tenby; accessible without a boat only at very low tide. Its appearance is that of a small patch, from one to two inches in diameter, of dark clot of blood adhering closely to the surface of the rock, and it can be obtained only by cutting away the piece of stone to which it adheres. It rarely exceeds about half a line in thickness. Its extreme thinness readily distinguishes it from the deep red coloured sponge, *Chalina seriata*, which occurs abundantly along with it in that cave, and which is so thick as to be easily removed from the rock with a knife.

In the living condition I could not detect the oscula, but in the dried state, by the aid of a two inch lens, they appear to be numerous, and dispersed equally over the surface of the sponge. I could not find the pores.

The columns of keratode rarely exceed in height the length of one of the large skeleton spicula, and are frequently not more than half or a third of that length; they never appear to anastomose with each other, but are united at their bases by a uniform thin stratum of keratode or condensed membranous basal tissue, in which is imbedded, without order, numerous slender sub-clavato-acuate spicula, with a few tricurvato-acerate ones, and from the bases of the columns we find occasionally a single entirely spined sub-clavato-attenuato-acuate defensive spiculum projected. The dermal membrane also abounds with the same description of spicula that we observe in the basal stratum. It is situated immediately above the apices of the keratose columns, and in the intervals between them it is supported and strengthened by the numerous long slender tension spicula which cross each other in various directions; the large terminal spicula passing through it powerfully protects it from injuries from without.

The spiculae of the skeleton are unlike those of any other sponge with which I am acquainted. They are curved considerably, and constricted at about once their own diameter from the base, so as to become sub-spinulate; beyond this constriction they dilate rather suddenly, and are fusiform for about one third their own length, and thence to the apex they are regularly attenuated; sometimes the sub-spinulation is scarcely perceptible, or entirely absent, but the fusiform character appears to be constant. The bases of the skeleton spiculae are not immersed in the keratose column, but are firmly cemented to its external surface. They are projected from all parts of it, at angles varying from 10 or 12 to 45 degrees, and the terminal ones form a radiating defensive group, from three to five or six in number, the convex side of the spiculum being always outward. The extreme height from the base of the keratose column to the apices of the terminal spicula in two cases measured, was  $\frac{1}{50}$ th and  $\frac{1}{4}$ th inch.

The anchorate spiculae are few in number, and are irregularly dispersed on the dermal membrane; they are very minute, and a few of them appeared to be palmato-anchorate.

The growth and development of the pedestals is very interesting. The terminal groups of the large defensive spiculae are first developed on the basal membrane in a sessile condition, and the increment of the keratode is from beneath them; they are thus gradually elevated from the basal membrane, the lateral spiculae being successively produced in accordance with the necessities of their positions.

I have obtained this species abundantly from the small reefs of rock exposed at low water opposite the town of Hastings, through the medium of Mr. Henry Ridley, where he states it frequently covers the surface of the sandstone in patches ten or twelve inches in diameter, and I have one specimen in my collection about seven inches long by four in breadth. Although thus spreading so widely, it does not appear to increase in thickness. However carefully dried, after a time it loses its red colour, and assumes a brown or a dirty green hue.

A hasty observer may readily mistake this species for

*M. armata*; the general aspect of the two when mounted as sections in Canada balsam are very similar, but the greater length and strength of the terminal spicula of the skeleton columns, the powerfully recurvedly spinous internal defensive spicula, and the anguloid tricurvate-acerate tension spicula so abundant on the interstitial membranes of *M. armata*, on a closer examination readily separate the two species..

*Genus—HYMERA PHIA, Bowerbank.*

SECTION \* \* Skeleton spicula, acuate.

1. *Hymeraphia vermiculata*, Bowerbank.
2. — *clavata*, Bowerbank.

SECTION \* \* \* Skeleton spicula, spinulate.

3. *Hymeraphia verticillata*, Bowerbank.
4. — *stellifera*, Bowerbank.

1. **HYMERA PHIA VERMICULATA, Bowerbank.**

**Sponge.** Coating; surface uneven and cavernous; strongly hispid. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane spiculous; spicula acuate, long, and exceedingly slender, variable in size; fasciculated? Skeleton and external defensive spicula acuate, large and long. Spicula of the basal membrane inequacerate, vermiculoid, rather large and stout, exceedingly variable in tortuosity.

**Colour.**—Dried, light buff yellow.

**Habitat.**—Shetland, in deep water, Mr. Barlee, Mr. C. W. Peach, and Rev. W. Gregor.

**Examined.**—In the dried state.

I am indebted to my friend Mr. Barlee for this interesting species. I received four specimens, three of which were coating small pebbles. None of them exceeded four lines in diameter, and the thickness not more than that of a sheet of writing paper. The colour is a light buff yellow, and with a lens of two inches focus the long spicula may be seen projecting from the surface of the sponge, like minute bristles. By the aid of a Lieberkuhn and a power of 100 linear, the surface appears very uneven, full of abrupt depressions and elevations, and a few minute simple oscula were apparent.

When a portion of the sponge was removed from the stone and mounted in Canada balsam, the dermal membrane appeared to be very delicate, and to be lined with a thin coat of sarcode, but I could not either by this mode of mounting, or by any other means, detect the spicula of that membrane *in situ*. On treating a piece of the sponge with boiling nitric acid, in a small dished cell, I obtained them in considerable numbers, and the greater portion of them were collected in regular fasciculi; and from this mode of arrangement, and the peculiarities of their structure, there is no doubt in my own mind that they were liberated by the action of the acid from the dermal membrane. They are so slender that they require a linear power of 500 or 600 to define their structure and proportions accurately. The skeleton and external defensive spicula appear enormously large in proportion to the thickness of the sponge and its remaining tissues. The whole of them have the base firmly cemented to the basal membrane, whence they are projected through the mass of sarcode, the dermal membrane, and far beyond its surface, and at about right angles to it.

The basal membrane of this sponge presents a novel and very singular appearance. It is abundantly furnished with inequi-acerate vermiculoid spicula lying on the surface of the membrane, and presenting an appearance very like a congregation of the vibrios of sour paste. No two of them are alike in their contortions, length, or thickness, and in their disposition they pass under and over each

other in every possible manner, so as completely to form a loose felting of siliceous spicula. The basal ends of the large skeleton ones pass through this stratum of spicula, and in several instances I observed that the points of the vermiculoid ones coiled closely round their bases so as materially to assist them in maintaining their position on the basal membrane.

The vermiculoid spicula do not appear to be equally abundant in every specimen of the species, as in sponges subsequently examined they were comparatively few in number, and in one case they were dispersed and unconnected with each other, and this did not appear to arise from an immature condition of the sponge, as in other respects it appeared to be fully developed.

I have subsequently received specimens on old shells and pebbles, from the Rev. Walter Gregor, dredged in the Moray Frith, and others from Mr. Peach. None of these specimens exceeded three fourths of an inch in diameter.

## 2. HYMERA PHIA CLAVATA, *Bowerbank.*

**Sponge.** Coating thin; surface even, strongly hispid. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane spiculous; spicula attenuato-acuate, long and slender, fasciculated, fasciculi frequently arranged in radiating groups. Skeleton and external defensive spicula attenuato-acuate, long and stout, rarely sub-clavate, variable in size and length. Internal defensive spicula attenuato-clavate, entirely spined. Tension spicula attenuato-acuate, long, and very slender, fasciculated. Basal membrane pellucid, smooth, and even. Sarcode abundant.

**Colour.**—Dried, light amber.

**Habitat.**—Shetland, Mr. Barlee; Moray Frith, Rev. Walter Gregor.

**Examined.**—In the dried state.

I have to thank my friend, Mr. Barlee, for this new species. He took two specimens at Shetland during his deep sea dredging at that locality, in 1858. One coats a portion of the outer surface of a valve of a dead shell of *Astarte Scotica*, covering a space of about eight lines in diameter. It is exceedingly thin, and, in the dried state, can only be distinguished from the dark periostracum of the shell by the grains of extraneous matter which are abundant on its surface, and by the reflection of the light from the long spicula which are projected from it.

The height of the sponge from the basal membrane on which the bases of the skeleton spicula are fixed, to the apex of the largest of them, does not exceed about a line. I could not get a section of the sponge at right angles to its base, but if we may judge by the length of the internal defensive spicula, the height from the base to the dermal surface would not exceed 1-150th of an inch.—The second specimen covered the surface of a small pebble for the space of three fourths of an inch in length by half an inch in breadth, and the sponge presented the appearance of a thin, brown incrustation. The minute oscula, irregularly dispersed on its surface, were visible by the aid of a lens of two inches focus. When a portion of the sponge was immersed in Canada balsam, the dermal membrane was seen to be abundantly furnished with tension spicula, sometimes dispersed singly, but most frequently collected in fasciculi, which were often congregated in radiating groups. The inner margin of an osculum on this piece of the sponge was well supplied with internal defensive spicula.

The large spicula of the sponge serve the purpose of both skeleton and external defensive spicula. They are projected at nearly right angles from the basal membrane, and extend far beyond the dermal surface; among them, and imbedded in the sarcodite, I found one very stout, short, cylindrical spiculum, but this I believe to be only an abnormal form of the usual skeleton ones, which, with very rare exceptions, are regularly acuate.

The internal defensive spicula vary considerably in size; I measured one of the longest and one of the shortest of

them, and they were  $\frac{1}{16}$ th of an inch and  $\frac{1}{15}$ th of an inch in length. The whole of them are distinctly clavate at the base. The spines are short, conical, acutely terminated, and very numerous.

The tension spicula of the interstitial tissues are exceedingly slender; the greater portion of them are collected into fasciculi, each containing a considerable number of spicula, the bases and apices in each bundle being always coincident. The fasciculi occur singly, and are irregularly dispersed on the surface of the basal membrane. A solitary spiculum may be observed occasionally, but this appears to be rather the exception than the rule. In a young specimen of this species sent to me by the Rev. Walter Gregor, late of Macduff, from the Moray Frith, the skeleton spicula were nearly all clavate or sub-spinulate, but this variation in their form was evidently due to incomplete development, the rest of the spicula also exhibiting evidence of immaturity. The colour, when alive, was light yellow. The specimen was dredged from forty-two fathoms, six miles off shore.

### 3. HYMERA PHIA VERTICELLATA, *Bowerbank.*

**Sponge.** Sessile, coating; surface uneven, with numerous conical projections. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula fusiformi-cylindrical, verticellately spined, very variable in size, dispersed. Skeleton: spicula attenuato-clavate, large and long, distal terminations obtuse, few in number; surrounded by numerous long and slender inflato-acerate spicula, with incisurate terminations. Interstitial membranes. Tension spicula very numerous, the same as those of the dermal membrane. Basal membrane abundantly spiculous; same as those of the dermal membrane; and long, slender, inflato-acerate spicula, with incisurate terminations, dispersed or loosely fasciculated. Ovaria membranous, aspiculous.

*Colour.*—Cream white.

*Locality.*—Western coast of Ireland; 100 fathoms.  
Captain Hoskins.

*Examined.*—Preserved in spirit.

This interesting species was brought up from a depth of 100 fathoms, by the sounding line, by the officers of H. M. ship Porcupine, and was sent to me for examination by my friend, Professor Wm. King, of Queen's College, Galway. It is in three pieces, neither of which exceeds half an inch in length and about two lines in thickness. The surface has a very peculiar appearance, being studded at irregular intervals with conical projections, which are produced by the distal terminations of the skeleton fasciculi pressing against the inner surface of the dermal membrane, and thus projecting it above the general surface of the sponge. The skeleton of this species differs from other British Hymeraphias in having the primary skeleton spicula each surrounded by a fasciculus of secondary skeleton spicula, serving to strengthen and extend the lines of the skeleton. These spicula are closely clustered around the primary ones; they are large and long, and attenuate gradually from the inflation at the middle to each termination, which presents a singular bifid appearance. The spicula of the dermal and interstitial membranes are also very remarkable, as they are the only verticellately spined spicula that are yet known to occur in a British sponge; the other two instances of the existence of verticellately spined spicula being in West Indian species, and in both these cases they are internal defensive organs, while in this sponge they are decidedly tension spicula. In the young state these spicula occasionally appear to be moniliform, and without spination, but this variation in form appears to arise from incomplete development.

#### 4. HYMERAPHIA STELLIFERA, *Bowerbank.*

Sponge. Coating, exceedingly thin. Surface even, strongly

hispid. Oscula and pores inconspicuous. Dermal membrane inconspicuous. 'Skeleton' and external defensive spicula, attenuato-clavate, long and slender, variable in length. Internal defensive spicula clavato-attenuato-cylindrical; apex stellately spinous. Basal membrane pellucid, smooth, and even. Sarcodæ thick and abundant.

*Colour*.—Dried, light amber yellow to orange yellow.

*Habitat*.—Shetland, Mr. Barlee; Moray Frith, Rev. Walter Gregor; Frith of Clyde, Rev. A. M. Norman.

*Examined*.—In the dried state.

I am indebted to my friend Mr. Barlec for two specimens of this interesting species. They were taken by him in the course of his deep-sea dredging at Shetland, in the year 1858. They occupy the insides of two valves of dead shells. In one of them, *Docinia lincta*, there is a thin patch of the sponge seven lines in length, and five in width. In the other shell, *Tapis aurita*, there is a specimen very similar in appearance to the first one, of six lines in diameter. The appearance of the sponge in both cases is like that of a thinly spread patch of gum or glue-water, dried on the surface of the shell; but with the aid of a lens of an inch focus, and by a little management of the light, the long projecting spicula of the sponge may be seen standing out from its surface in abundance. The sponge is extremely thin, the height from the basal membrane to the surface measured but  $\frac{1}{100}$ th inch; and from the basal membrane, whence the long spicula proceed, to the apex of the longest spiculum in the field of the microscope,  $\frac{1}{50}$ th inch.

I could not detect either oscula, pores, or a dermal membrane. When immersed in water the sarcodæ expanded to rather above the line of the largest of the internal defensive spicula, and the surface presented the usual slightly undulating gelatinoid appearance of that substance, but I could not detect either interstitial membrane or cavities.

The whole of the large spicula of the sponge serve the

double purpose of skeleton and defensive spicula; their bases are attached to the basal membrane of the sponge, and their direction is always at nearly right angles to it. They vary in length from  $\frac{1}{400}$ th inch to  $\frac{1}{50}$ th inch, and their structure is very remarkable; the clavate base is largely and strongly produced, while the shaft attenuates rapidly, and terminates in an extremely slender apex in the longest of them, while the shorter ones are much stouter in their proportions. This great inequality in length renders them very much more effective in their character of external defensive organs. Intermixed with the large attenuato-clavate spicula there are a few extremely slender acuate ones, but as their basement and their direction is precisely the same as the larger ones, I believe them to be only a very early stage of their development.

The internal defensive spicula, like the skeleton ones, are planted in the basal membrane, and their general direction is at about right angles to it. They vary in height from  $\frac{1}{500}$ th inch to  $\frac{1}{250}$ th inch, and their form is much like that of a Florence oil-flask with an elongated neck, and an ornamental stellate stopper, the stout conical radii or spines passing off in every direction, but emanating only from the apex of the spiculum. The spines terminate acutely, and their height is about twice that of their basal diameter. These spicula are not readily to be detected when the sponge is immersed in water, and it is only after immersion in Canada balsam that they become distinctly visible.

I subsequently received from the Rev. A. M. Norman a small branch of *Nullipora calcarea*? about four lines in length, and one and a half in diameter, covered with this sponge. The colour was much deeper and more inclined to red than that of Mr. Barlee's specimens. It was obtained by dredging off the Isle of Cumbrae, in the Frith of Clyde. It has also been obtained from the Moray Frith, by the Rev. Walter Gregor, late of Macduff. The specimens sent to me by that gentleman were in very fine condition, and the colour was a bright orange-yellow. There were three on the fragment of a large bivalve shell, but no one exceeded an inch in diameter.

*Genus—HYMEDESMIA, Bowerbank.*

## SECTION \* \* Skeleton spicula acuate.

1. *Hymedesmia radiata*, Bowerbank.

## SECTION \* \* \* Skeleton spicula spinulate.

2. *Hymedesmia stellata*, Bowerbank.

## SECTION \* \* \* \* Skeleton spicula cylindrical.

3. *Hymedesmia Zellandica*, Bowerbank.

1. HYMEDESMIA RADIATA, *Bowerbank.*

Sponge. Coating, very thin, surface even, smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane aspiculous, pellucid. Skeleton composed of numerous widely-radiating groups of long and slender attenuato-acerate spicula; groups irregularly dispersed; and also exceedingly large and long acuate or sub-clavated acuate spicula, irregularly dispersed amidst the skeleton tissues. Internal defensive spicula clavated attenuato-acuate, incipiently entirely spined, stout and variable in length, very numerous.

*Colour*.—Dried, light greenish-gray.

*Habitat*.—Shetland, Mr. C. W. Peach.

*Examined*.—In the dried state.

I am indebted to my friend Mr. Peach for this specimen, the first of the species I have seen. It coats very thinly a space on the surface of a fragment of a granite boulder, of about an average of two inches in diameter. It was dredged at Shetland, by Mr. J. G. Jeffreys, in 1864, and was preserved for me by Mr. Peach, who accompanied the expe-

dition. The surface in the dried state has a few of the longest of the interhal defensive spicula with their apices projecting through the dermal membrane, but this, I apprehend, is due to the contraction of the sponge in drying. The oscula are minute, and are only visible by the aid of an inch lens. The dermal membrane, strictly speaking, is aspiculous, as there are no tension or retentive spicula appropriated either to it or to the interstitial membranes ; but the large and widely-spreading groups of skeleton spicula are occasionally based on its inner surface, and thence radiate into the body of the sponge. But by far the greater number of these radiating groups are based on the basal or the interstitial membranes ; the spicula of the skeleton require a linear power of about 400 to render their form distinct. Their bases are irregularly crowded together, while their shafts are projected outward at every imaginable variety of angle. The supplementary large acuate or sub-clavated acuate spicula are a singular appendage to the skeleton ; they are of extreme length, and more than twice the largest diameter of the spicula of the radial groups, and are disposed in lines parallel to the basal membrane ; they are usually disposed singly, but occasionally two occur together, or very closely so. The internal defensive spicula are very numerous, and appear all to spring from the basal membrane, their diameter is nearly the same at the base, but they vary greatly in their length and also in the degree of their spinations ; in some the spines are quite in an incipient state, while in others they are well and distinctly produced.

## 2. HYMEDESMIA STELLATA, Bowerbank.

Sponge. Coating very thin ; surface even, hispid. Oscula simple, dispersed, minute. Pores inconspicuous. Dermal and basal membranes abundantly spiculous ; spicula cylindro-stellate, very minute. Skeleton : spicula ovo-spinulate, very large and long, variable in size, closely fasciculated, bases and apices concurrent.

External defensive spicula attenuato-acuate or sub-spinulate, occasionally abnormo-spinulate. Interstitial spicula dispersed or fasciculated; bases and apices concurrent in the fasciculi; attenuato-spinulate, very slender.

*Colour.*—Dried, light fawn.

*Habitat.*—Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

I have seen but one specimen of this species. It coats a space equal to a square of the size of about half an inch, in a straggling, irregular manner, on the inside of the half of an old bivalve shell. The surface is strongly hispid, by the projection through the dermal membrane of the external defensive spicula. The dermal membrane is so crowded with the cylindro-stellate spicula, as to greatly impede the view of the interior of the sponge; these spicula are very minute, and require a microscopic power of 600 or 700 linear to define them accurately. The ovo-spinulate spicula of the fasciculi of the skeleton are very large and long, and their oviform bases are large and well produced. The fasciculi are very compactly formed, and the bases and apices always occupy the same relative positions. The fasciculi do not assume any particular direction, but are irregularly dispersed amid the tissues. The basal membrane appears to be as crowded with stellate spicula as the dermal one, but the sponge is so very thin that it is difficult to distinguish the one from the other; whether viewed through the back or the front of the sponge, the skeleton fasciculi are always beneath the stellate membrane, so that no doubt can exist as to its presence. The external defensive spicula springs from the basal membrane, and pass for a great portion of their length through the dermal one, radiating thence in every direction; they are not so regular in their form as those of the skeleton, and are regularly attenuated from their bases to their apices. The interstitial spicula appear to be dispersed to about the same extent; they are fasciculated, and are much smaller and more slender than the external defensive ones.

### 3. HYMEDESMIA ZETLANDICA, *Bowerbank.*

Sponge. Coating very thin; surface smooth and even.

Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton: spicula sub-biclavated, cylindrical, numerously fasciculated, rather large, of nearly uniform size and proportions. Internal defensive spicula attenuato-acuate, entirely and strongly spined; large and stout, rather numerous; spines conical, acute, often recurvate. Retentive spicula bidentate and tridentate equi-anchorate, rather stout and numerous, dispersed; and simple bihamate, large, but very slender, fasciculated, fasciculi numerous, dispersed.

*Colour.*—Dried, buff yellow.

*Habitat.*—Deep sea, Shetland, Mr. Barlee.

*Examined.*—In the dried state.

I am indebted to my indefatigable friend Mr. Barlee for this sponge. He obtained it in the course of his deep-sea dredging at Shetland, in 1858. There are two small patches of it on the front margin of a valve of *Dociinia exolita*, one on the outer and the other on the inner surface of the shell; neither of them exceed a quarter of an inch in diameter. I have also three other small specimens of it of similar dimensions, on the two sides of a flat pebble about three fourths of an inch in diameter, from the same locality. One of them is in juxtaposition with a specimen of *Hymeraphia vermiculata*, from which it may be readily distinguished by a lens of an inch focus, by its smooth surface, and by the total absence of large external defensive spicula. I could not detect the oscula without the aid of a microscopic power of about 100 linear, and by direct light. They were few in number, and very small. The spicula in the fasciculi of the skeleton are very numerous. The bundles are dispersed irregularly in all parts of the sponge,

between the basal membrane and the dermal one, sometimes crossing each other, but frequently entirely isolated. Their length very little exceeds that of a single spiculum.

The internal defensive spicula are large and stout in their proportions. They vary in length from  $\frac{1}{128}$ th inch to  $\frac{1}{158}$ th inch. In some of the dried specimens of the sponge the points of the larger ones project beyond the surface, giving it when viewed by direct light, with a power of 100 linear, a slightly hispid appearance; but as this evidently arises from the contraction of the sponge in drying, it is not probable that it would be apparent in the living state. They are dispersed on the surface of the basal membrane, at about equal distances from each other. Their spination is very abundant to within a short distance of the apex, which is smooth and acute, and at the base of the spiculum they are abundant and very strongly produced.

The retentive spicula are most abundant on the inner surface of the basal membrane, but a few comparatively, are dispersed in the interstitial tissues among the fasciculi of the skeleton. The bidentate and tridentate equi-anchorate spicula are stout and strong in their proportions, and the dentæ are more than usually widely spread. They are dispersed equally on the surface of the basal membrane. The simple bihamate spicula are about twice the length of the anchorate ones, but their shafts are of extreme tenuity, a portion of them are in groups, as if the bundles had been partially broken up and dispersed, and occasionally isolated spicula occur, but their usual mode of disposition is in compact fasciculi, each consisting of a considerable number of spicula, the hami being all coincident. This is the first instance I have met with in which spicula of this form have been collected in fasciculi. The thickness of this species in the dried condition does not exceed  $\frac{1}{150}$ th inch; in the living state it may probably be  $\frac{1}{50}$ th inch in thickness, but although of such slight dimensions, the fully developed condition of all its organs indicates an adult state of the specimen.

**HYMENIACIDON, BOWERBANK.****SECTION \* Skeleton spicula, acerate.**

1. *Hymeniacidon Thomasi*, Bowerbank.
2. — *coccinea*, Bowerbank.
3. — *Brettii*, Bowerbank.
4. — *fragilis*, Bowerbank.
5. — *reticulatus*, Bowerbank.
6. — *fallaciosus*, Bowerbank.
7. — *abescens*, Bowerbank.
8. — *lactea*, Bowerbank.
9. — *perarmatus*, Bowerbank.
10. — *membrana*, Bowerbank.

**SECTION \*\* Skeleton spicula, acuate.***Sub-section A. Skeleton spicula, smooth.*

11. *Hymeniacidon caruncula*, Bowerbank.
12. — *sanguinea*, Bowerbank.
13. — *mammeata*, Bowerbank.
14. — *consimilis*, Bowerbank.
15. — *variantia*, Bowerbank.
16. — *macilenta*, Bowerbank.
17. — *fallax*, Bowerbank.
18. — *viridans*, Bowerbank.
19. — *perlevis*, Bowerbank.
20. — *aurea*, Bowerbank.
21. — *armatura*, Bowerbank.
22. — *pachyderma*, Bowerbank.
23. — *crustula*, Bowerbank.
24. — *lingua*, Bowerbank.
25. — *floreum*, Bowerbank.
26. — *virgultosa*, Bowerbank.

*Sub-section B. Skeleton spicula, spinous.*

27. *Hymeniacidon plumosa*, Bowerbank.
28. — *jecusculum*, Bowerbank.

## SECTION \* \* \* Skeleton spicula, spinulate.

*Sub-section A, Skeleton spicula, smooth.*

29. *Hymeniacidon suberga*, Bowerbank.  
 30. — *carnosa*, Bowerbank.  
 31. — *ficus*, Bowerbank.  
 32. — *sulphurea*, Bowerbank.  
 33. — *sub-clavata*, Bowerbank.  
 34. — *clavigera*, Bowerbank.  
 35. — *celata*, Bowerbank.  
 36. — *gelatinosa*, Bowerbank.

*Sub-section B, Skeleton spicula, spinous.*

37. *Hymeniacidon paupertas*, Bowerbank.

## SECTION \* \* \* \* Skeleton spicula, cylindrical.

38. *Hymeniacidon Dujardinii*, Bowerbank.

## SECTION \* \* \* \* Skeleton spicula, angulated.

39. *Hymeniacidon Bucklandi*, Bowerbank.

## 1. HYMENIACIDON THOMASII, Bowerbank.

Sponge. Sessile massive, surface rugose. Oscula slightly elevated, few, dispersed. Pores conspicuous, not very abundant. Dermal membrane pellucid, thin, abundantly spiculous. Spicula: of the skeleton, acerate, stout, few; of the interstitial membranes, acerate, slender, abundant.

*Colour.*—Dried, buff yellow.

*Habitat.*—Black Rocks, Leith, Capt. F. W. L. Thomas, R.N.

*Examined.*—In the dried state.

The form of this sponge is nearly circular, the diameter being about two and a half inches. It is so much depressed that it does not exceed half an inch in thickness. There are two smooth spaces on the under side, about three eighths of an inch in diameter, which have apparently been points of adherence to a smooth surface. The remainder of the inferior portion is much like that of the superior one, excepting that there are no oscula apparent, these organs being confined to the upper surface and margin of the sponge; they are dispersed about an inch apart, and the largest rather exceeds two lines in diameter. The pores are apparent to the unassisted eye; they are comparatively not very numerous. The spicula of the skeleton are stout and slightly curved, and are comparatively by no means abundant; while those of the membranous structures are exceedingly numerous; the latter are slender and slightly curved. The dermal membrane is abundantly furnished with the slender spicula, intermixed with a small number of the larger ones. The interstitial membranes are crowded with the slender spicula, irregularly felted together, as it were, amid which the skeleton spicula are dispersed at intervals, singly or in small groups, comparatively considerable spaces in the membranes being without them.

At the first view dried specimens of this species may be readily mistaken for *H. caruncula*, the rugose surface being very similar to that of the latter species.

I am indebted for this sponge and many other valuable specimens to the liberality and kindness of my friend Capt. F. W. L. Thomas, R.N., who has done so much to advance our knowledge of marine natural history during his services as commander of the Hydrographical Survey in the Orkneys, Shetland, and the Frith of Forth, and in commemoration of which I have much pleasure in attaching his name to this new and interesting species.

## 2. HYMENIACIDON COCCINEA, *Bowerbank.*

Sponge. Amorphous sessile. Surface uneven, rugged.

Oscula minute, dispersed, numerous. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous, dispersed, same as those of the skeleton. Skeleton : spicula subfusiformi-acerate, large and rather long, and the same form short and slender. Gemmules membranous.

*Colour*.—Alive, scarlet, dried, light gray.

*Locality*.—Salcombe Bay, Devonshire, Mr. Alder.

*Examined*.—In the dried state.

I received two specimens of this sponge from my friend, Mr. Joshua Alder, of Newcastle-on-Tyne. In the box containing them there was also a small specimen of *Hymeniacidon caruncula*, from the same locality, and from the external appearances of the two species it would have been impossible to have distinguished the one species from the other ; and it would appear that the same difficulty exists in the living state. On referring to Mr. Alder regarding the colour when alive, he wrote as follows : “ I have no recollection about the sponges I got in Salcombe Bay, and the colour was the only memorandum I preserved. As I had put them together, I must have supposed them to be the same species, and I have therefore no doubt that they would be similarly coloured.” This similarity in colour would be very likely to mislead a casual observer, but the difference in form at once distinguishes the species. In the dried state *H. coccinea* and *H. Thomasii* might be mistaken for each other if external characters alone were referred to, but a comparison of the spicula of the two species readily distinguishes them, those of the latter species being nearly twice the size of the spicula in the former one.

Immediately beneath the dermal membrane there was a considerable number of membranous gemmules, variable in size, and each containing the usual granular vesicles.

**3. HYMENIACIDON BRETTII, *Bowerbank.***

**Sponge.** Encrusting, surface smooth, minutely reticulated. Oscula simple, small, dispersed. Pores inconspicuous, numerous. Dermal membrane rather stout, pellucid, abundantly spiculous. Spicula of the skeleton fusiformi-acerate, stout ; tension spicula of the interstitial membranes acerate, slender.

**Colour.**—Alive, externally cream, internally yellow.

**Habitat.**—Tenby, Mrs. Brett and J. S. Bowerbank ; Menai Straits, Mr. Alder.

**Examined.**—In the dried state.

I received this species, among others, from Mrs. Brett, of Tenby, by whom it was found on St. Katherine's Rock, between high and low water marks. The sponge was nearly covered by a specimen of *Isodictya rosea*. It is nine lines in length, six in breadth, and does not exceed three in thickness. The surface is undulating and smooth, and is minutely reticulated ; when viewed through an inch lens it has much the same appearance as that of *Halichondria panicea*, but the reticulations are finer than in that species. The oscula are very small, not exceeding one third, or one fourth, of a line in diameter, and although so minute they are not numerous. The pores are abundant and equally distributed over the whole of the surface, and are in a great measure the cause of its reticulated appearance. The dermal membrane is rather stout, but pellucid. It is abundantly spiculous, and the spicula are collected into loose, and often continuous fasciculi, which have a tendency to cross each other at nearly right angles ; the prevailing spicula are the slender acerate ones, but there is a considerable intermixture of the stout fusiformi-acerate ones of the skeleton.

I have named it in honour of its discoverer, Mrs. Brett,

of Tenby, an ardent and successful cultivator of marine natural history.

#### 4. HYMENIACIDON FRAGILIS, *Bowerbank.*

Sponge. Branched and inosculating, sessile; surface uneven, smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, spiculous; spicula fusiformi-acerate; arranged in an irregular multisporular network. Skeleton spicula fusiformi-acerate, stout, irregular in size.

*Colour.*—Alive, various shades of green and flesh colour.

*Habitat.*—Mouth of the Dart, Devonshire, Bowerbank.

*Examined.*—In the fresh state.

This sponge is exceedingly common about a mile within the mouth of the Dart, where an abundance of it was cast up by the tide. It is extremely fragile at all times, and when dry very light and friable; the general texture of the sponge is exceedingly cavernous and irregular. Although the surface is uneven and rugose, it is in no respect hispid, as the dermal membrane follows every sinuation of the exterior. The colour of many of the specimens when fresh was more or less green, and a portion of them flesh-coloured. The dried specimens generally assume a pallid hue.

#### 5. HYMENIACIDON RETICULATUS, *Bowerbank.*

Sponge. Sessile, coating. Surface even, smooth. Oscula congregated in marginated areas, or simple and marginated. Pores inconspicuous. Dermal membrane translucent, spiculo-reticulate, rete irregular, strong, and multisporular. Skeleton: spicula acerate, stout, and acuate, slender.

*Colour.*—Dried, light fawn or cream-colour.

*Habitat.*—Strorna, Shetland, Mr. C. W. Peach.

*Examined.*—In the dried state.

At the first glance at this sponge, with a two inch lens, the student might readily mistake it for a dried coating specimen of *Halichondria panicea*, the reticulated surface of each so closely resembling the other; but the peculiarities of the oscula areas will quickly remove such an erroneous impression. These organs are remarkable in their characters. In some of the areas five or six oscula of various sizes are congregated, while others contain but a single osculum. The margins of the areas are slightly elevated, and are thin at the edges, and for a short distance surrounding them the reticulations of the dermal membrane are obsolete, and in their places we find the spicula arranged in nearly parallel lines, converging towards the margin of the area, rendering the tissues close and dense in their structure. The same arrangement prevails around the margins of the single oscula. The reticulations of the dermal membrane are very irregular in size, and the spicula of the network far too numerous to be counted. In other respects, the tissues of this sponge are extremely simple, the spicula of all parts being of the same form, but somewhat variable in size.

The sponge covers a surface of about one and a half square inches, and does not exceed about two lines in thickness. It is seated on a portion of a flat boulder, and was dredged by Mr. J. Gwyn Jeffreys, at Shetland, in 1864, and preserved for me by my friend Mr. Peach, who accompanied the expedition.

#### 6. HYMENIACIDON FALLACIOSUS, *Bowerbank.*

*Sponge.* Sessile, coating fuci or zoophytes. Surface smooth, minutely reticulated. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane translucent, spiculo-reticulate; rete irregular, multi-

spiculate and strong ; spicula acerate, large. Skeleton. Abundantly spiculous ; spicula large and long.

*Colour*.—Dried, lurid pale green.

*Habitat*.—Coast of Northumberland, Rev. A. M. Norman.

*Examined*.—In the dried state.

I received a single specimen of this sponge from the Rev. A. M. Norman. It entirely enveloped a cluster of Tubularia two and a half inches long, and was, at its broadest part, nearly an inch in width. A cursory observer would be very liable to mistake it for a specimen of *Halichondria panicea* in its dried state, the reticulated surfaces of each being very similar ; but the difference in their anatomical structure readily distinguishes them. The same reticulated surface also exists in dried specimens of *H. reticulatus*, but the dissimilarity in colour, and the dispersion of the oscula, instead of being congregated in marginated areas serves to distinguish them. The anatomical structure of each is also very similar, and they are not readily separated by description alone, but when the structures of the two species are microscopically compared, the difference in the size of the spicula, and the shorter and stronger character of the whole of the structures of *H. fallaciosus* compared with those of *H. reticulatus* is strikingly apparent ; an adult spiculum of the former being to a full grown one of the latter as five to three, with a corresponding increase of diameter.

#### HYMENIACIDON ALBESCENS, *Bowerbank*.

*HALICHONDRIA ALBESCENS*, *Johnston*.

Sponge. Massive, sessile ; eliminating one, or rarely more, irregularly cylindrical virgultose branch, or branches from its apex ; branches occasionally dividing into two. Surface smooth. Oscula simply dispersed,

few in number. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton. Spicula fusiformi-acerate, large and long.

*Colour*.—Alive ; lemon-yellow ; dried state, white.

*Habitat*.—Berwick Bay, Dr. Johnston; Roundham Head, Torbay, Mr. Gosse ; Guliot Caves, Sark, J. S. Bowerbank.

*Examined*.—In the living state.

I am indebted to my friend, Mr. Gosse, for my first knowledge of this species, as although described by Dr. Johnston, in his 'History of British Sponges,' I could not find it among the sponges deposited by him in the British Museum, as the types of the species described in that work. Mr. Gosse states that he found the specimens he sent to me "on the under surfaces of boulders and cromlechs of soft red sandstone, at Roundham Head, Torbay," and he also describes the colour when alive as "a pale buff or drab," and that they were abundant. A few weeks after receiving them from Mr. Gosse, I found the same species in the sides of the rocks of the celebrated Guliot Caves, in the island of Sark, in considerable quantity.

The sponge in its living condition is of a lemon yellow colour, but it loses this tint in drying, and becomes of a silvery white. Dr. Johnston's description of its colour would, therefore, be correct, supposing his specimens to have been found on fuci cast' up by the sea, and the sponge in a dead condition. In the living condition, the surface is quite smooth, but in the dried state it is often slightly hispid from the contraction of the sponge in drying, and the consequent protrusion of some of the spicula near the surface, through the dermal membrane. The specimens which I found in the Guliot Caves were most frequently parasitical on Zoophites or on small Balani, and in this habit they also agree with those found by Dr. Johnston. From all these circumstances, I am strongly inclined to believe that the species found by Mr. Gosse and by me, and that designated by Dr. Johnston *Halichondria albescens* are the same.

The tallest specimen did not exceed two and a half inches in length, and was about a line in diameter, until near the distal end, when it expanded to about a line and a half. This specimen was from Torquay. The stoutest specimen was from the Guliot Caves in Sark; it was two inches long, was largest about the middle, and the greatest diameter was three lines.

The base consists of a small irregular sessile mass, from the top of which a single virgultose branch springs, generally very much more attenuated at the lower end than at its middle or near its apex, where it frequently expands to one and a half or twice its previous diameter; sometimes but not very frequently assuming a pear-shaped distal extremity, but more frequently gradually attenuating from the expanded portion to its apex. Occasionally, the branch divides into two, but this is not of very frequent occurrence.

In young, and apparently immature specimens, the basal mass is often not present, the sponge consisting of a single irregularly cylindrical virgultose branch, and in this condition it frequently attains two inches in height.

The structure of this species is very simple, no other form of spicula existing in it than those of the skeleton, but they are very abundant and variable in size. I could not detect the oscula in the living specimens, but in the dried condition they were very apparent, but few in number. In the latter condition, the pores also were visible when viewed by direct light with a power of 100 linear.

The specimens were abundant for about six feet from low water mark at spring tides, in the sides of the north end of the furthest of the two large caves from the approach by land, and which can be only reached by land at low spring tides.

#### 8. HYMENIACIDON LACTEA, Bowerbank.

Sponge. Coating, surface smooth and even. Oscula simple, dispersed, minute. Pores inconspicuous.

Dermal membrane pellucid, abundantly spiculous; spicula acerate, long, and slender, dispersed. Skeleton. Spicula acerate, long, and slender, larger and stouter than those of the dermal membrane.

*Colour.*—Dried, milk white.

*Habitat.*—Moray Firth, Rev. Walter Gregor.

*Examined.*—In the dried state.

This remarkable sponge existed in several small patches, on a fragment of a dead shell of a large *Pecten*, about two inches in length by one in breadth. There were six or seven small patches, none of which exceeded three lines in breadth, or about six or eight in length, and the thickness did not in any one exceed that of thin writing paper.

The dermal membrane is crowded with spicula of the same form as those of the skeleton, but somewhat less in length and diameter. It is difficult to trace the interstitial membranes, as the sponge is so thin that it is, in truth, nearly all dermal membrane, and in many places in the pieces examined, there appeared to be nothing in the shape of interstitial tissues between the dermal and basal membranes.

#### 9. HYMENIACIDON PERARMATUS, *Bowerbank.*

**Sponge.** Coating, thin; surface smooth and even. Oscula numerous, dispersed, slightly elevated. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula dispersed, acerate, long, and large; profusely furnished with large equi-anchorate bi- and tri-dentate retentive spicula. Skeleton. Spicula acerate, long, and large, very abundant. Interstitial membranes abundantly furnished with large bi- and tri-dentate, equi-anchorate, retentive spicula. Internal defensive spicula attenuato-clavate entirely spined, large, very variable in length and size.

*Colour.*—Dried, light buff yellow.

*Habitat.*—Forty miles east Outer Skerries, Shetland,  
Rev. A. M. Norman.

*Examined.*—In the dried state.

I am indebted to my indefatigable friend the Rev. A. M. Norman for my knowledge of this species; he obtained it by dredging. The specimen is nearly two inches in length and breadth, and about a line and a half in thickness. The oscula are nearly uniform in size, none exceeding about a line and a half in diameter, and they are elevated above the surface about one third or half a line. The spicula of the dermal membrane are the same as those of the skeleton; and among them the bi- and tridentate equi-anchorate retentive spicula, are abundantly dispersed, and comparatively they are very stout and large; no internal defensive attenuato-clavate spicula appear among them. The skeleton spicula are exceedingly abundant, and are very closely matted together, and occasionally they are sub-fasciculate. The internal defensive spicula frequently exceed the skeleton ones in length. The extremely long ones appear all of them to spring from the basal membrane of the sponge, while the shorter varieties are situated on the interstitial membranes. The spination of these spicula is exceedingly abundant especially at their club-shaped bases. These spicula very closely resemble the corresponding organs in *Hymeniacidon clavigera*, but there is no difficulty in discriminating the species, as their skeleton spicula are distinctly different in form.

#### 10. HYMENIACIDON MEMBRANA, Bowerbank.

- Sponge. Coating, thin; surface smooth and even. Oscula dispersed, simple or slightly elevated; few in number, and rather large. Pores inconspicuous. Dermal membrane abundantly spiculous. Spicula same as those of the skeleton. Skeleton. Spicula acerate, small, but not long in proportion; numerous; very rarely acuate.

*Colour.*—In the dried state, cream white.

*Habitat.*—Surface of stones between tide-marks, Lerwick, Rev. A. M. Norman.

*Examined.*—In the dried state.

I received seven specimens of this sponge, spread out and dried on paper, from the Rev. A. M. Norman, who found it on stones at Lerwick. The largest measured about two and a half inches long, by nearly two inches wide, and in its dried state it was scarcely thicker than the piece of stout paper to which it was attached. In general appearance the specimen very closely resembled large patches of stout animal membrane, such as those of the thinnest portion of the diaphragm of a sheep.

There is a great paucity of structural characters in this species. No other forms of spicula appear to exist in it than those of the skeleton, and the difference in size and proportions of the spicula of the skeleton and those of the dermal and interstitial membranes is scarcely to be recognised. It is fortunate that its external characters are strikingly different from those of the species to which it is most nearly allied in structure.

#### 11. HYMENIACIDON CARUNCULA, Bowerbank.

Sponge. Coating, thick; surface uneven, but smooth. Oscula, simple, small, dispersed, few. Pores inconspicuous, minute. Dermal membrane pellucid, thin, abundantly spiculous; spicula acuate, slender, irregularly dispersed, very numerous. Skeleton. Spicula acuate, rather stout. Interstitial membranes, tension spicula acuate, slender.

*Colour.*—Alive, from light to deep orange.

*Habitat.*—St. Katherine's Cave, Tenby; Guliot Caves, Sark; Hastings; Mill Bay, near Land's End, Cornwall, J. S. Bowerbank; Bantry Bay, Ireland, Rev. A. M.

Norman ; Salcombe Bay, Devon, and Menai Straits, Mr. Joshua Alder ; Weymouth Bay, Mr. William Thompson.

• *Examined.*—In the living state.

This species is one of the best types of the structural peculiarities of the genus to which it belongs. It is abundant on the rocks between high and low water mark in St. Katherine's Cave, at Tenby, and on other parts of the neighbouring rocks. It occurs in irregular patches, sometimes five or six inches in diameter, and from half to one inch in thickness, varying in colour from a light yellow orange to a deep red orange, and sometimes having a slight tint of green. In its live condition it is firm and flesh-like, both to the sight and the touch, and this appearance attends it also in the dried state. The oscula are few in number, and rarely exceed a line in diameter. The pores are barely visible in a dried specimen through a two-inch lens. The dermal membrane is abundantly supplied with spicula, similar in form to those of the skeleton, but much more slender ; they are closely, but regularly, matted together. The tension spicula are not numerous ; they are of the same form as those of the skeleton, but slender and often flexuous, and some of them are of extreme tenuity.

I never detected gemmules in either the Tenby or the Sark specimens ; but in one from Bantry Bay, three and a half inches in length by about one and a half broad, and half an inch in thickness, sent to me for examination by the Rev. Mr. Norman, I found them scattered rather sparingly through the tissues. They were spherical, membranous, and aspiculous, and filled with minute vesicles. The largest I observed measured  $\frac{1}{1200}$ th of an inch in diameter, and a smaller one  $\frac{1}{2000}$ th of an inch. The colour was that of dark red amber. The specimen sent to me by Mr. William Thompson, of Weymouth, was five inches in length, three inches in width, and about three fourths of an inch in thickness, having the surface covered with small rugged mammæform projections. In April, 1854, I found several specimens of this sponge on the base of the rocks at low-water mark spring tides opposite the archway dividing St.

Leonard's from Hastings. In many cases it was completely covered by *Halichondria panicea*, and was to be seen only when the latter was removed from the rock by a knife. Although thus covered, it was apparently in a healthy condition, and was covered with mammæform projections of about the eighth of an inch in height. The colour was deep orange red. The specimens I found at Mill Bay, Cornwall, were smooth and even at the surface in the live state, but assumed a slightly corrugated state when dried. I have in some specimens observed that the dermal and interstitial membranes have been minutely granulated, but this does not appear to be a constant character; when present, it requires a power of about 500 linear to render the granules distinctly visible.

## 12. HYMENIACIDON SANGUINEA, *Bowerbank.*

*SPONGIA SANGUINEA*, *Grant.*  
*HALICHONDRIA SANGUINEA*, *Fleming.*  
 — — — *Johnston.*

Sponge. Encrusting; surface smooth and undulating, or rugged, with ridges or elevations. Oscula simple, numerous, small. Pores inconspicuous. Dermal membrane abundantly spiculous; spicula acuate, long and slender, irregularly dispersed. Skeleton. Spicula acuate, stout and long, often slightly flexuous.

*Colour*.—Alive, deep blood red.

*Habitat*.—Dublin Bay, Lambay Island, William Thompson, Esq.; Berwick Bay, Dr. Johnston; Staffa, Iona, Isle of Skye, Dr. Grant; Island of Bofin, Connemara, Rev. Robert Hudson; Roundstone Bay, Ireland, and Island of Arran, Ireland, J. S. Bowerbank.

*Examined*.—In the dried state.

In the Johnstonian collection of British sponges at the British Museum there are five specimens, labelled *Halichondria sanguinea*, distinguished as 27a, 27b, 27c, 27d.

27a has two pieces on the card so numbered, one larger than the other, and each differing from the other in specific characters. The smaller specimen, labelled 27a and 27d, are the same species, and appear identical with *Hymeniacidon caruncula* of this work; 27b and 27c are the same species, having spicula of the same form as those of *H. caruncula*, but very much longer; 27a, the largest specimen, has spicula of an acerate form, differing entirely from the other four specimens. Thus, in the five specimens we recognise three species under the single designation of *Halichondria sanguinea*. The two specimens distinguished as 27b and 27c appear to answer best to the description given by Dr. Johnston of his *Halichondria sanguinea*, and I therefore propose to confine the specific name *Sanguinea* to them. They differ considerably from each other in size and the characters of the surface, so much so that Dr. Johnston has labelled 27b as an abnormal form, but this discrepancy, when we consider the difference in size and development of the two specimens, is of very little value in this tribe of sponges. 27c is thirteen inches long, by seven lines wide, and about the eighth of an inch in thickness, and is stated to have been found in Berwick Bay, and we may therefore presume that it agreed in colour with the description given of *H. sanguinea* in his work, as well as in having the acuate spicula long.

The specimen labelled 27b, *Halichondria sanguinea abnormal*, is very much larger than any of the other specimens with which it is associated. It is nearly three inches long, by two inches broad, of an irregularly oval form, and its greatest thickness rather exceeds half an inch. The surface is very uneven and rugged, full of conical projections and short ridges, some of which are nearly half an inch in height. The oscula are numerous and comparatively large; they are situated both on the sides and the apices of the ridges or cones, which cover the surface of the sponge.

In *Hymeniacidon caruncula* the acuate spicula are considerably shorter than in the sponge to which I propose to confine the term *Sanguinea*, but beside this difference in character, there are others which assist us in our discrimi-

nation of the species. Thus Dr. Johnston states his *H. sanguinea* to be of "a deep blood-red colour," and Dr. Grant also states that "it has always the same deep red colour," while I have never found *Hymeniacidon caruncula* of a blood-red, and never approaching that colour nearer than that of a full orange tint, which in drying always changes to a rich cream yellow, sometimes with a shade of green.

On measuring the length of a full-sized spiculum of the sponge marked 27c, it proved to be  $\frac{1}{3}$ rd of an inch long, while a full-sized spiculum of *H. caruncula*, from Tenby, measured  $\frac{1}{15}$ th of an inch in length.

Since writing the above I have received five specimens of this species from my friend the Rev. Robert Hudson, who found them "under a rock at the Island of Bofin, midway between Achil Head and Slyne Head, Connemara. One of the specimens measured six inches long, four broad, and about eight lines thick in the dried state, and one specimen exceeded an inch in thickness, and in the dried condition all of them were of a deep blood-red, and my friend describes them when alive as of "a deep scarlet colour."

I found this species at near low-water mark at the Isles of Arran, Galway, of a deep blood-red colour, with sometimes a superficial tint of green.

### 13. HYMENIACIDON MAMMEA, *Bowerbank*:

**Sponge.** Sessile, coating; surface furnished abundantly with large and prominent mammæ; minutely hispid. Oscula and pores inconspicuous. Dermis stout; dermal membrane pellucid, abundantly spiculous; spicula acuate, slender, dispersed. Skeleton. Strong and cavernous, abundantly spiculous; spicula fusiformi-acuate, large, and long, and the same form small and slender. External defensive spicula fusiformi-acuate, short and small, very numerous.

**Colour.**—Dried, nut brown.

*Habitat.*—Three miles off Dunstanborough, Rev. A. M. Norman.

*Examined.*—In the dried state.

At the first sight, this sponge might readily be mistaken for a variety of *Polymastia mammillaris*. It is about two inches in diameter, and does not exceed half an inch in thickness, and its surface is abundantly furnished with the mammaeform organs, some of which exceed half an inch in length, two lines in diameter, and about one line at the distal extremity. Others are broader, shorter, and more conical, no two appearing to be precisely alike in form and proportions. Their anatomical structure is also entirely different from the similar shaped organs on *Polymastia*, their interior being filled with the same description of skeleton tissue as that forming the body of the sponge, and this mass of interstitial structure is traversed by several excurrent canals, which run nearly parallel to each other from the base of each of the mammae to the apex. The interior structure of the sponge is also remarkable, the abundance of spicula in the membranes of the skeleton, their consequent thickness, and the large size of the intermarginal cavities, causes the specimen in the dried condition to simulate very closely the appearance of the skeleton of a *Desmacidon*; but a microscopical examination of its structure speedily relieves us of any doubts regarding its true character.

This species in the dried state may be readily mistaken for *H. consimilis* by a hasty examination, but for the difference in its colour, and in the proportions of its spicula as compared with those of that species which are in length only as four to seven in the sponge under consideration. The possession of external defensive spicula also, which do not exist in *H. consimilis*, serve still further to distinguish them.

No oscula could be detected on the mass of the sponge, but from the structures of the mammae their absence might be expected, the numerous and large longitudinal canals on those organs sufficiently indicating their office and the position of the oscula, although not visible under

the present circumstances. The dermal tension and defensive spicula are exceedingly abundant in all parts of the external surface of the sponge, and so also are the spicula of the skeleton on the membranes on which they are disposed.

#### 14. HYMENIACIDON CONSIMILIS, *Bowerbank.*

**Sponge.** Sessile, coating. Surface rugose, but not hispid, furnished abundantly with large and prominent mammae. Oscula simple, dispersed. Pores inconspicuous. Dermis stout; dermal membrane pellucid, abundantly spiculous, spicula rather short and stout, same as those of the skeleton, depressed, very numerous. Skeleton. Abundantly spiculous; spicula subfusiformi-acuate, short, and stout, numerous.

**Colour.**—Alive, bright orange, sometimes with a tint of green. When dried, externally, greenish gray; internally, deep red.

**Habitat.**—Belgrave Bay, Guernsey; and Herm, between tide marks, Rev. A. M. Norman.

**Examined.**—In the dried state.

I received six specimens of this species from the Rev. Mr. Norman. The largest was nearly two and a quarter inches in diameter, and rather short of an inch in thickness; the smallest an inch and half in length, by three fourths of an inch in breadth, and rather exceeding half an inch in thickness. The upper surface of each of them was so completely crowded with mammaeform bodies as to entirely obscure the dermal surface of the sponge; in the larger specimens, they were inclined at various angles towards the surface of the sponges, but in the three smaller specimens they were at nearly right angles to the surface. Their normal form appears to be conical, but they are subject to great variations in shape, sometimes being acutely conical about three or four times the height of the

diameter of the base, at others, terminating very abruptly and obtusely. In some of the oldest specimens, two, three, or more of the mammae unite at their bases, forming a stout short column for about half their height, but terminating in separate short cones. In the dried state, their surfaces are very much corrugated by collapse of the dermis inward. Their usual height is five or six lines, with a basal diameter of about two lines. The structure of the exteriors of these organs is the same as that of the body of the sponge, each one having two or three large excurrent canals extending the whole of their length; I could not detect any terminal oscula, but in several instances I found open oscula on their sides, rather smaller than those dispersed on the body of the sponge.

There are two species with which this sponge may possibly be confounded. The greenish gray dermis, and deep red interstitial tissues of *H. consimilis* closely resemble the corresponding tissues of *H. sanguinea*, and the spicula of the skeleton of the former are of the same form as those of the latter species; but they are rather shorter, and considerably stouter than those of *H. sanguinea*. The dermal membranes of both species are abundantly furnished with irregularly dispersed spicula, but they are much more numerous in *H. consimilis*. These comparatively slight differences would scarcely have led us to have considered them as distinct species, if it were not that the striking differences in form are such as to at once claim our attention. I have seen many species of *H. sanguinea*, and have never observed the slightest indication of the production of the irregular mammaeform organs which are so abundant on all the six specimens of *H. consimilis*. These strictly external characters, therefore, become of greater value in this case than is usually attributed to them; and in addition to the structural differences, slight as they are, after a careful examination, they appear to fully warrant the separation of the two species. The reverse of the case which I have just described exists in the comparison of *H. consimilis* and *H. mammata*. Here we have the massive sessile forms and mammæated surface of each species closely resembling

the other. The general anatomical characters of the interstitial structures also harmonise in a remarkable manner; and the spicula of the skeletons are of the same form; but there is one important difference which is decisive in the separation of the species, and that is the great difference existing in their proportions, the spicula of *H. mammeata*, being nearly twice the length of those of *H. consimilis*; the former being to the latter as seven to four; an amount of difference that is never found to exist in the organs of any two specimens of the same species, however they may vary in size, age, or mode of development. The hispidation of the surface of *H. mammeata* also serves as an essential differential character. Mr. Norman has informed me that he found this sponge living "on the upper surface of rocks between tide marks near low-water at Belgrave Bay, Guernsey, and at Herm, and that it lives in places exposed to the full light and rays of the sun."

### 15. HYMENIACIDON VARIANTIA, *Bowerbank.*

Sponge. Massive; surface rugged. Oscula simple, dispersed, numerous. Pores inconspicuous. Dermal membrane pellucid, spiculous; tension spicula acuate, minute, fasciculated, retentive spicula, bihamate, simple, and contort, large, and small. Skeleton. Spicula, acuate, elongate, often flexuous, occasionally short and flecto- or inflato-acuate, rarely acerate or cylindrical. Interstitial membranes; tension spicula acuate, stout, few in numbers and acuate, very minute and slender, numerous, and most abundantly with fasciculi of minute acerate, and large and small bihamate spicula. Sarcodes abundant.

*Colour.*—Alive and dried, light gray.

*Habitat.*—St. Katherine's Rock, Tenby, Mrs. Brett.

*Examined.*—Dried.

The type specimen in its present form is eight lines in

length by six in breadth, and the same in height, but it is evidently a portion only of the original mass. Mrs. Brett, to whom I am indebted for my knowledge of this species, obtained it between the tide marks on the northern side of St. Katherine's Rock, at Tenby, and the colour, I am informed, was the same when alive as when dried, light gray, approaching closely to white. .

The variation in the size, and the modifications in the form of the spicula of the skeleton is remarkable. The normal form is evidently acuate, elongate, and not flexuous; the short and stout varieties of the normal form are often flecto-attenuato-acuate, and the longer and more attenuated varieties of the normal form are usually more or less flexuous. Acerate or cylindrical spicula are of rare occurrence, and are often inflated near the middle of the spiculum.

The skeleton spicula vary from  $\frac{1}{10}$ th to  $\frac{1}{50}$ th of an inch in length. The same tendency to great variation in size here prevails among the bihamate spicula, but of these there appears to be two distinct groups, one ranging in length from  $\frac{1}{500}$ th to  $\frac{1}{100}$ th of an inch, and the other from  $\frac{1}{1000}$ th to  $\frac{1}{5000}$ th inch. The latter are infinitely more numerous than the former ones, but both are intermixed on the surface of the membranes without the slightest appearance of arrangement, while the minute acerate spicula of the same tissues are usually collected in fasciculi, irregularly disposed on the surface of the membranes. These spicula do not exceed  $\frac{1}{100}$ th part of an inch in length, and are exceedingly slender. The slender flexuous acuate spicula abound on the surface of the interstitial membranes, and they are also intermingled with those of the skeleton. The flecto-acuate spicula are considerable in number, and somewhat uniform in size, but I could not ascertain that they were peculiar to any one portion of the sponge. The inflato-acuate are rather rare, the inflation is tolerably uniform in size but not in position, sometimes being in the middle of the shaft, and at others near its base.

In the dried condition, the texture of this sponge is very open and cavernous.

16. *HYMENIACIDON MACILENTA*, *Bowerbank*.

**Sponge.** Sessile, coating thinly Zoophytes, &c. Surface smooth, but uneven and rugged. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane abundantly spiculous; tension spicula sub-clavate acuate, long and very slender, numerous, dispersed; and a few tricurvato-acerate, long and slender; terminal curves nearly obsolete; retentive spicula, inequibidentate and dentato-palmate anchorate, the two in about equal quantities, small and few in number; and dentato-palmate anchorate very minute, few in number; also contort-bihamate, large and very numerous. Skeleton. Spicula sub-clavate acuate, rather short and stout. Interstitial membranes: spicula same as those of the dermal membrane.

**Colour.**—Alive, scarlet; dried, dark brown.

**Habitat.**—Island of Herm, Rev. A. M. Norman.

**Examined.**—In the dried state.

I received two specimens of this sponge from the Rev. A. M. Norman, each consisting of several fragments; the largest piece slightly exceeded an inch in length, and was about three lines in width. In the dried state the aspect of the sponge is like that of a thin slice of flesh, roughly dried, with the blood coating it; in the living condition Mr. Norman states that it was of a bright scarlet colour.

The basal enlargement of the skeleton spicula is usually very slight, and in many of them it is scarcely perceptible, but it is as prevalent in the young skeleton spicula and in the skeleton tension ones as it is in the fully-developed skeleton spicula. The acinate tension spicula are exceedingly slender and long in proportion to their diameter; they frequently attain the length of half that of an adult skeleton one; the tri-curve ones also attain about the same length, the central curve is well produced, but the terminal ones are

sometimes scarcely to be perceived. The largest of the anchorate spicula are by no means numerous; both forms are about equal in size; the small ones are very minute, and do not exceed about one third the length of the larger descriptions of those organs, and they also are very few in number, and are by no means easily detected *in situ*, even when mounted in Canada balsam. Among the retentive spicula, the contort bihamate ones are by far the most numerous, and form one of the most striking characters of the species; they are about three times the length of the largest of the anchorate ones, and are stout in proportion, and they appear to abound in all parts of the membranous tissues.

#### 17. HYMENIACIDON FALLAX, *Bowerbank.*

**Sponge.** Massive, sessile; surface smooth, but uneven. Oscula simple, dispersed. Pores inconspicuous, not numerous. Dermal membrane thin, transparent, with a dense, irregular stratum of spicula, attached to and immediately beneath it. Skeleton. Spicula, acuate, sub-fusiform, and rarely sub-spinulate. Interstitial membranes: spicula of the same form as those of the skeleton, but slender and flexuous. Sarcode abundant.

**Colour.**—Dried, light ash colour.

**Locality.**—Torbay, Mrs. Griffiths.

**Examined.**—When dry.

The form of the only specimen I have seen of this species is that of an irregularly compressed fig. It is an inch and a half in height, by one inch in breadth, and does not exceed half an inch in thickness. I have designated it *fallax* from the close resemblance that exists between its spicula and those of *Hymeniacidon Alderi*, but the sub-spinulate character is wanting in the latter species.

If it should prove hereafter that the external form and general character of *H. fallax* is tolerably constant, those

characters will generally serve to distinguish the one from the other, and among the structural characters the marked difference that exists between the dermal membranes and their associated spicula, and the absence of granulation in the dermal and other membranes of *H. fallax*, will aid essentially in the separation of the two species.

I am indebted to the late Mrs. Griffiths, of Torquay, for this sponge. She obtained it from one of the trawlers, and it was probably from Torbay.

### 18. HYMENIACIDON VIRIDANS, *Bowerbank.*

**Sponge.** Coating ; surface even, minutely corrugated, slightly hispid. Oscula slightly elevated and margined, dispersed. Pores inconspicuous, congregated. Dermal membrane spiculous ; spicula abundant, same as those of the skeleton, dispersed or sub-fasciculated. Skeleton. Spicula acuate, moderately stout. Tension spicula acuate, slender, as long as those of the skeleton. Gemmules spherical, membranous, aspiculous.

**Colour.**—Alive, red tinted with green ; dried, green externally, buff yellow internally.

**Habitat.**—Bantry Bay, Rev. A. M. Norman.

**Examined.**—In the dried state.

I am indebted to the Rev. A. M. Norman for my knowledge of this species. He sent me for examination a single specimen in excellent preservation, two and a half inches long, two inches wide, and about four and a half lines in thickness, the external colour being a rather pale but vivid green. The surface was even, but minutely and strikingly corrugated, in the dried sponge ; but in the living condition it is probable that the surface would be nearly, if not entirely, free from the corrugations. When a slice from the dermal surface was examined in a little water, with a power of 160 linear, the elevated portions of the corrugations were found to be most abundantly spiculous, while the depressed parts were each occupied by

several little areas, nearly free from spicula, and in each of these there were congregated from one to five or six pores, irregular both in size and position. These groups of pores were separated from each other by one or more loose fasciculations of spicula. The slightly hispid character was produced by the partial projection of portions of these fasciculi, disposed on the sides of the elevated parts of the corrugations. A few small groups of pores were visible on the tops of the ridges, but by far the greater number of groups were in the depressed portions of the dermal surface. The oscula were very slightly elevated above the general surface, and their margins were a little thickened and quite smooth.

The difference in thickness between the skeleton and tension spicula is not so great as it is in some of the nearly allied species, the diameters of the latter being seldom less than about half that of the former.

The gemmules are of a deep red amber colour, and are filled with minute molecules. They vary in diameter from  $\frac{1}{1875}$ th of an inch to  $\frac{1}{63}$ nd of an inch, but by far the greater number are about intermediate between these figures.

The colour of this sponge renders it very liable to be mistaken for *Halichondria panicea*, but a very slight amount of examination will readily separate them from each other.

Mr. Norman's specimens were found on shelving rocks between high- and low-water marks.

#### 19. HYMENIACLDON PERLEVIS, *Bowerbank.*

*SPONGIA PERLEVIS*, *Montagu.*  
*HALICHONDRIA PERLEVIS*, *Johnston.*

**Sponge.** Massive, depressed, sessile; upper surface furnished with numerous irregular mammatiform processes. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane simple, pellucid, aspiculous, thin. Spicula of the skeleton acuate, sub-fusiform, rarely sub-spinulate. Sarcodite abundant. Gemmules membranous, aspiculous, round, or oval.

*Colour.*—Alive, yellow; dried, buff yellow.

*Locality.*—Coast of Devon, Mrs. Griffiths.

*Examined.*—In the dried state.

The above description is from the original type specimen of Montagu, in the possession of Professor Grant. The sponge is one and a half inch long, three fourths of an inch wide, and not exceeding half an inch in height. The mammæform processes are irregular in form, compressed towards the base, and rarely exceeding two or three lines in height, and internally they are of the same structure as the body of the sponge. The under surface of the sponge is nodulous and uneven, and I could not distinguish the point or points of attachment, if there be any such. The sunken portions of the under surface are furnished with as many oscula as the upper one, where the oscula are dispersed between the bases of the mammæform processes, and it is evident that the species, in this case, is not a coating one.

The spicula present much irregularity of size and form, and are occasionally, but rarely, spinulate; in the mammæform processes they radiate irregularly towards the surface, from immediately beneath it, but not in right lines from the axis of the process.

In a second specimen in the cabinet of the late Mrs. Griffiths the spicula are somewhat longer than in the type sponge, and the mammæform processes do not appear, but the surface is extremely rugged and uneven. The mammæ, as a character, although so striking in the type specimen, can scarcely be considered as necessarily a specific one, and may probably, when we know more of this species, be entirely dispensed with. As in the first specimen, there is no distinct base to the sponge, but the under surface is filled with small stones and shells partially imbedded. The specimen has twice the area of the type one, but is not quite so thick.

In a third specimen, sent to me for examination in 1859 by the Rev. A. M. Norman, the mammæform processes were large and numerous, some of them exceeding half an inch in height, and usually had a large terminal osculum, with a

smooth margin. The rest of the surface of the sponge was exceedingly rugged and full of furrows, and in every other essential character it agreed with the type specimen. It was an inch and a half in length, by about one inch in width, and about three fourths of an inch in height.

In Montagu's specimen there are a few gemmules near the surface of the sponge; they are of the form so common to the *Halichondraceous* tribe; membranous, aspiculous, round, or oval, and of a deep amber colour.

## 20. HYMENIACIDON AUREA, *Bowerbank.*

*SPONGIA AUREA*, *Montagu.*

*HALICHONDRIA AUREA*, *Fleming and Johnston.*

Sponge. Sessile, massive, terminating in elongated processes, or coating. Surface smooth and even. Oscula simple, dispersed, few in number. Pores inconspicuous. Dermal membrane abundantly spiculous; spicula acuate, long, slender, and flexuous. Skeleton. Spicula sub-fusiform acuate, stout, and long. Tension spicula of interstitial membranes, acuate, long, slender, and flexuous, abundant. Gemmules spherical, membranous, aspiculous.

*Colour.*—Alive, orange yellow; dried, dark brown.

*Locality.*—Estuary of Kingsbridge, Montagu; Tenby, J. S. Bowerbank; Bantry Bay, Rev. A. M. Norman.

*Examined.*—In the dried state.

Montagu's description of this sponge is exceedingly meager, and embraces only form and colour. The specimen is of a compressed form, three inches in length by five-eighths of an inch in breadth, and nearly two inches high to the apices of the elongated processes, some of which exceed an inch in height; they are from four to six lines in diameter at the base, and taper gradually upwards to a bluntly-pointed termination.

I could find very few oscula by the aid of an inch lens; they were simple orifices, and were scattered on the broad sides of the sponge. In the live state it is probable that they would be more conspicuous. The pores are very few in number, and were rarely to be seen, even with a power of 250 linear. This may probably arise from the large quantity of dried sarcodite with which the membranes are obscured. The dermal membrane is abundantly furnished with spicula, which frequently assume a flat fascicular arrangement near the margins of the oscula. At other parts of it they are distributed without order, as in the interstitial membranes.

Montagu has not figured this species, but I have no doubt that the specimen I have described above is the one to which he alludes in his description in 'The Memoirs of the Wernerian Society,' vol. ii, p. 86. The specimen is now in the possession of Dr. Grant, with the original label attached to it.

There is a specimen in the British Museum, labelled by Dr. Johnston *Halichondria aurea*, but it does not belong to the same genus as the sponge described above. It is *Isodectya permollis* of this work.

I dredged up two specimens of this species at Tenby, both of them coating oyster shells, but neither of them rising from the base, as in Montagu's specimen. In colour, both in the living and dead states, they agree completely with Montagu's type specimen, and in all the anatomical details they cannot be distinguished from each other. With these important characters in unison, the difference in form is scarcely worthy of a consideration. I subsequently received two small specimens of this species from the Rev. A. M. Norman, who found them in Bantry Bay in 1859. In these specimens there were a number of vesicular bodies, which had every appearance of being the gemmules. They were  $\frac{1}{12}$ th of an inch in diameter, when fully developed. The membranous coat of the gemmules was aspiculous. They were filled with minute vesicular molecules.

21. HYMENIACIDON ARMATURA, *Bowerbank.*

Sponge. Coating, thin; surface smooth. Oscula simple, dispersed, minute. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula cylindrical, sometimes sub-clavate, dispersed or loosely fasciculated. Skeleton. Spicula acuate, stout. Interstitial membranes; tension spicula numerous, same as those of dermal membrane. Internal defensive spicula acuate, entirely spined, few in number.

*Colour.*—Dried, dark red brown.

*Habitat.*—Strangford Lough, Professor Dickie.

*Examined.*—In the dried state.

I received this sponge from Professor Dickie, of Queen's College, Belfast. It covers nearly the whole of the valve of a small Pecten, rather less than an inch and a half in width, and in its dried state it does not exceed a line in thickness. There are a few small oscula near the margin of the sponge, visible by the assistance of a lens of two inches' focus, but I could not detect a single pore open. The dermal membrane is crowded with tension spicula, irregularly dispersed on its surface, and sometimes loosely fasciculated, and they appear to be equally abundant in the interstitial membranes. When fully developed, these spicula are sometimes slightly dilated at their terminations. They are nearly as long as the acuate skeleton spicula, but only about half their diameter. The internal defensive spicula are sparingly dispersed over the inner surface of the dermal membrane and on the interstitial ones, and were mostly in a recumbent position; they are small, and require a power of about 400 linear to exhibit them well, and without immersion in Canada balsam they are not to be detected *in situ*.

**22. HYMENIACIDON PACHYDERMA, Bowerbank.**

Sponge. Massive, sessile; surface corrugated. Oscula small, simple, dispersed. • Pores inconspicuous. Dermis crustular thin, abundantly spiculous; spicula acuate, stout, matted closely together. Dermal membrane thin, pellucid, aspiculous. Spicula: of the skeleton, acuate, rather stout and short, occasionally bent near the base; tension spicula acuate, slender, and often sinuous.

*Colour*.—Dried: external, cream colour; internal, light brown.

*Habitat*.—Torquay, Mrs. Griffiths.

*Examined*.—In the dried state.

I am indebted to my late friend Mrs. Griffiths, of Torquay, for two specimens of this species. Neither of them exceeds an inch in length, by three fourths of an inch in breadth and half an inch in thickness. The surface in each is corrugated, but much more so in one than in the other; in the remaining characters they agree very closely. The oscula are small, and require the assistance of a two inch lens to render them distinctly visible, and the pores, even with the aid of an inch lens, are inconspicuous. The crustaceous dermis is about the thickness of a stout sheet of letter paper. It is composed of acuate spicula, like those of the skeleton, closely but irregularly interwoven together, and covered with a thin pellucid dermal membrane, in which no spicula are apparent excepting those belonging to the dermis, to which it adheres closely and firmly. The spicula of the skeleton are rather stout, variable in length, and are frequently more or less bent near the base. The slender acuate tension spicula intermixed with those of the skeleton are frequently much attenuated, and are often sinuous. The interior substance of the sponge is permeated in every direction by canals, which are very much larger and more numerous than

might have been expected, from comparison with the size of the oscula and pores.

The crustular characters of the dermis of the species under consideration and of *H. crustula* might, on a superficial examination, lead to their being mistaken for each other ; but in *H. pachyderma* the crustular dermis is comparatively thin, and the skeleton spicula are not more than two fifths the length of those of *H. crustula*.

### 23. HYMENIACIDON CRUSTULA, *Bowerbank*.

Sponge. Massive, sessile. Surface minutely hispid ; corrugated, occasionally mammillated. Oscula, terminal on the mammillæ, or dispersed. Pores inconspicuous. Dermis crustular, abundantly spiculous ; spicula same as those of the skeleton. Dermal membrane pellucid, aspiculous. Skeleton, abundantly spiculous ; spicula fusiformi-acuate, large, and long. Tension spicula fusiformi-acuate, slender ; occasionally sub-spinulate. External defensive spicula sub-fusiformi-acuate, short and slender.

*Colour*.—Alive, buff-yellow or orange-yellow.

*Habitat*.—Scarborough, Mr. Bean ; Guernsey, Rev. A. M. Norman ; Diamond Ground, Hastings, J. S. Bowerbank.

*Examined*.—In the living state.

I am indebted to my indefatigable friend Mr. Bean for my first knowledge of this sponge. It was found on the beach at Scarborough, at the latter end of March, 1854. The specimen is irregularly cylindrical in form, with hemispherical ends 10 lines in length and 6 lines in thickness, at its greatest diameter. Neither pores nor oscula were visible, and the surface was smooth, the dermal membrane having been destroyed apparently by maceration.

At the latter end of August, 1859, I received two specimens of this sponge from the Rev. A. M. Norman, who dredged them up in the neighbourhood of Guernsey. The largest of these was one and three quarters of an inch in length, one and a quarter inch in breadth, and half an inch in thickness ; the smaller one somewhat less in its dimensions, but the surface of each was prominently and abundantly mammillated, and especially the smaller of the two. In the larger of the two specimens, particularly on the corrugated portions of the surface, the positions of the pores were distinctly visible by the aid of a lens of two inches focus, and with a higher power they presented the appearance of minute pits, but they were not to be detected by the same means on the surface of the smaller of the two specimens.

The hispid character is not visible by the aid of a hand lens, but when a section at right angles to the surface is examined with a power of about 100 linear, it is seen to be produced by the projection at about right angles to the surface of an infinite number of small sub-fusiformi-acuate spicula.

In the largest of Mr. Norman's specimens there were two minute oscula in an open condition, on the corrugated surface of the sponge ; they were simple circular orifices, with this exception, I could not detect these organs in an open state, but longitudinal and transverse sections of the apices of the mammillæ appeared to indicate their position at those points, beyond a reasonable doubt. The pores were also in a closed state, but their positions were indicated by the numerous little areas, free or nearly free from spicula, which abound in the dermal tissue.

The crustular character of the dermal tissue is not produced by a peculiar arrangement of the organic tissues, but it is caused by a more condensed state of a stratum of the ordinary tissues of the sponge, and in this layer, beneath each of the porous areas, there is an intermarginal cavity to receive and convey the incurrent streams to the interior of the sponge.

It is not improbable that we may hereafter find that each of the porous areas in the dermal membrane may have

more than a single pore, and in that case the congregation of the pores will become a very important specific character. The existence of these areas and their intermarginal cavities approximates the dermal tissues of this sponge to those of the corresponding parts of the genera *Pachymatisma* and *Geodia*. When the sponge, as in Mr. Bean's specimen, has not a mammillated surface, it may, in the dried condition, be readily mistaken for *Hymeniacidon pachyderma*, but the difference is at once obvious when reference is made to the spicula. In the latter species they are not fusiform, and their length is only as two to five of those of the former species.

I obtained at Hastings, at the latter end of March, 1863, a still finer specimen of this sponge. It was two and a half inches long, one and a half inches wide, and one inch thick. As in the former cases there were no marks of an attachment or base visible, and although a fully matured sponge, there were no appearances of mammillation on its surface. The oscula at one side were congregated to the amount of twelve or fourteen, but in other parts they were irregularly dispersed. From these circumstances, as compared with those of the previously described specimens, it appears as if there existed a great amount of variation in the external characters of this species.

An abundance of gemmules existed in this sponge, attached to the parietes of the interstitial cavities. They were globular, membranaceous, and aspiculous, semi-transparent, and filled with distinct granular matter, and they were of a light amber colour. The diameter of a full sized one was  $\frac{1}{16}$  inch. In the living condition the colour of the sponge was a light orange; when dried, light ochreous yellow, and in the latter state it is very hard and solid.

#### 24. HYMENACIDON LINGUA, *Bowerbank.*

Sponge. Massive, sessile; surface somewhat corrugated. Oscula simple, dispersed. Pores inconspicuous. Der-

mal membrane pellucid, furnished abundantly with large spicula, same as those of the skeleton. Skeleton. Spicula abundant, fasciculated, fusiformi-acuate, large and long. Tension spicula acuate, very minute and slender. Retentive spicula bihamate, simple and contort, dispersed, minute, very abundant; also dentato-palmate, unequi-anchorate, large and small; large ones congregated in rosette-shaped or globose groups; occasionally dispersed; small ones dispersed.

*Colour.*—In spirit and dry, pallid gray.

*Locality.*—Western Islands, Scotland, Mr. Archibald McNab; Outer Skerries and Unst, Shetland, Mr. C. W. Peach.

*Examined.*—In the condition it came from the sea, and preserved in spirit.

I received three specimens of this sponge from Mr. Archibald McNab, a fisherman at Inverary. They are of nearly equal size and form, about three inches in length by one and a half inches in width, and from half to three fourths of an inch in thickness; very nearly resembling in form a similar length from the distal end of the tongue of a sheep.

When in the undried condition the sponge is exceedingly soft and flaccid, and it was with considerable difficulty I could detect the oscula, in consequence of the collapsed condition of the sponge. It does not contract much in drying, and when in that state it strongly resembles a mass of chopped tow, which has been compressed in the hand while wet and dried in that form.

The structure of the skeleton is obscure; in many parts the spicula, especially towards the edges of the interstitial membranes are so numerous and so closely packed together as to assume the form of fasciculi, and in some measure that of the skeleton of a *Halichondria*; but there are no distinct angular junctions forming an irregular network, as in even the most indistinct species of *Halichondria*. The fusiformi-acuate spicula of the skeleton have many of

them a peculiarity in their form that I have not observed before. From the obtuse base of the spiculum they continue of the same size for the length of six or eight times their own diameter, and then suddenly commence the fusiform expansion, giving them the appearance of having a handle at the basal extremity. The tension spicula are very minute, and are frequently collected into groups or fasciculi, which contain a considerable number. The contort bihamate spicula are dispersed in the sarcode; they are minute, short, and if not contort would be nearly semi-lunar in form. The anchorate spicula are exceedingly interesting; they are large and stout, the palm at one extremity is much expanded, while that at the opposite end is not produced to anything like the same degree. From the constant inequality in the production of these parts of the spiculum, I was led to believe that there must be some peculiar arrangement of these organs, and on carefully examining the inner surface of the dermal membrane, I found my suspicions were correct. They are congregated at distant intervals in radiating circles, containing sometimes not more than six or eight spicula, while in other groups they are too numerous to be counted. The groups are usually semi-globose, the smaller ends of the spicula being based on the membrane, but occasionally they become perfectly globose, the proximal ends of the spicula constituting the centre of the group, which then appears to be entirely detached from the membrane beneath. The globose congregations of spicula are not nearly so numerous as the rosette-shaped ones. I could not detect any congregations of these spicula on the interstitial membranes, but isolated ones were occasionally found upon them. The smaller variety of anchorate spicula never appear to congregate.

The skeleton spicula are exceedingly abundant, and are so massed together as to assume the appearance of large fasciculi, when the membranes are presented to the eye either edgeways or obliquely.

The sarcode abounds in globular nucleated cells, which have the surface granulated, or corrugated; the latter appearance may probably be due to the action of the spirit

in which they have been immersed. Since the above description was written I have received five specimens of this species from my friend Mr. C. W. Peach, they were dredged at Shetland, in 1864. The largest was twelve inches high, six inches broad, an inch thick near one edge, and a quarter of an inch at the middle; one only of the five was as small as the type specimen, and the others of intermediate size, one of them, seven inches in length, was two and a half inches thick near the base. Mr. Peach, in a label attached to the largest specimen, writes: "This was a thick sponge, very full of glairy matter, and branched, but was cut to pieces by the dredge, and rotted in drying. Very deep water, Outer Skerries and Unst."

The statement of its having been branched must, I think, have been a mistake, as there are no indication of branches on the specimen to which the label was attached, nor any appearance of a tendency to branch in any other of the specimens. This sponge, it is evident, varies greatly in size, but all of them have more or less of a lingual form, and in their anatomical characters they agreed perfectly with the type specimen.

## 25. HYMENIACIDON FLOREUM, *Bowerbank.*

Sponge. Coating, thin; surface smooth and even. Oscula simple, minute, dispersed. Pores inconspicuous. Dermal membrane pellucid, sparingly furnished with dispersed slender sub-clavate, fusiformi-acuate, tension spicula. Skeleton. Spicula sub-clavate fusiformi-acuate, stout and rather long. Tension spicula of interstitial membranes same as the dermal ones. Retentive spicula dentato-palmate inequi-anchorate, large and stout; distal palm, half as long as the spiculum, congregated in numerous radial groups; and bidentate inequi-anchorates few in number, and intermixed in the radial groups; also, deflected and contort bihamate spicula, very large and stout, and few in number; and simple bihamate very minute, and rather numerous.

*Colour*.—Dried, deep amber colour.

*Habitat*.—East Loch, Tarbet, Harris, N.B., 15 fathoms, Captain F. W. L. Thomas, R.N.; Strangford Lough, Professor Dickie, Queen's College, Belfast.

*Examined*.—In the dried state.

For the first specimen I received of this interesting species I am indebted to the liberality and kindness of my friend Captain Thomas, of the Hydrographical Survey. The sponge covers nearly the whole of the gibbous valve of a specimen of *Pecten opercularis*, and in the dried state it is scarcely thicker than a sheet of stout writing-paper, and has much the aspect of a layer of dried glue. The surface is uniform and even. A few minute oscula were visible by the aid of a lens of two inches focus, but no traces of the pores could be detected. The interstitial membranes are profusely furnished with skeleton spicula, and when seen edgeways look very like large long sinuous fasciculi of spicula. The tension spicula are few in number. The sarcodite is abundant, and of a deep amber colour. The prominent feature in this sponge is the striking form and mode of arrangement of the retentive spicula, and especially so of the dentato-palmate inequi-anchorate ones, which in this sponge are developed in a more complete and perfect form than I have hitherto seen; they are in great abundance, and nearly the whole of them are congregated in beautiful rosette-shaped groups, the small or proximal ends of the spicula being clustered together in the centre, while the shafts and distal palms radiate at angles of about 45 degrees from the membrane on which they are seated, the number of spicula in each group varying from six or seven to seventeen or twenty, and sometimes more. On some parts of the membranous tissues they are more numerous than on others, and in one case I counted fifteen groups in a circle of  $\frac{1}{3}$ rd of an inch in diameter. Occasionally a solitary spiculum of this form may be seen on the membrane, but these single spicula are comparatively few in number. The bidentate inequi-anchorate spicula are much fewer in number than the den-

tato-palmate ones, but they are of the same size, and are indiscriminately mixed with them in the radial groups.

The next most remarkable feature in this interesting sponge is the comparatively enormous size of the deflected and contort bihamate spicula, which are of such dimensions that a single one would span a whole group of the anchorate ones ; they are attached by their points to the membrane, while their curved shafts are thrown upward amidst the sarcodes. They are very few in number, and are widely dispersed.

The small simple bihamate spicula are much more numerous than the large ones, and are as remarkable for their minuteness as the larger ones are for their great size : without the aid of a power of about 400 linear, they can scarcely be detected *in situ*, although the specimen be immersed in Canada balsam, and it must be remembered that without this mode of preparation even the radial groups will not become visible.

I subsequently received a second specimen of this sponge from Professor Dickie, of Queen's College, Belfast, and this one also was on a shell of *Pecten opercularis*. It occupied about half an inch in width of the whole front of the shell, while the remainder of the valve was covered with *Hali-chondria nigricans*. The essential characters of this specimen of *Hymeniacidon floreum* were in accordance with those of the first, but in the part examined the rosette-like groups of spicula were very few in number. The specimen being young and very thin may probably account for the difference between the two in this respect.

There are some peculiarities in this species which might readily mislead a hasty observer into the belief that it was a variety in form of *Hymeniacidon lingua*. Thus the strikingly characteristic groups of retentive spicula resemble each other in both form and mode of arrangement so closely that if it were not that they are rather less than half the diameter in *H. floreum*, of those in *H. lingua*, it would be difficult to distinguish one from the other. The spicula of the skeleton also rather closely resemble each other, but those of *H. floreum* differ from the skeleton spicula of *H. lingua* in

being not more than half the length and diameter of the latter, and in the basal end being somewhat clavate, which is not the case in *H. lingua*. In other points the specific differences are very decided and effective.

## 26. HYMENIACIDON VIRGULTOSA, *Bowerbank.*

HALICHONDRIA VIRGULTOSA, *Johnston.*

Sponge. Parasitical, coating Zoophytes or Fuci, elongate or virgultose, more or less compressed; surface smooth. Oscula and pores inconspicuous. Dermal membrane pellucid, spiculous, furnished abundantly with minute inflato-cylindrical spicula, irregularly dispersed. Skeleton. Spicula acuate, long, very rarely sub-spinulate. Interstitial membranes attenuato-acuate, long and slender, and rarely with minute inflato-cylindrical spicula.

*Colour.*—Dried, light buff yellow.

*Habitat.*—Dogger Bank, Mr. Peter Cullen.

*Examined.*—In the dried state.

The type specimen of this species, described by Dr. Johnston, in his 'History of British Sponges,' page 137, is in the possession of Mr. Bean, of Scarborough, where I have had the pleasure of seeing it. The form of the specimen, before it was broken, was that of a slender, irregular cylinder, somewhat compressed and slightly twisted; it was about fifteen inches in length, and nearly half an inch in diameter. At the same period I obtained from Mr. Peter Cullen a series of the species of five specimens. The whole of these were from eight to eleven lines wide, and from two to five lines thick; the shortest was two inches and three quarters long, and the largest ten inches and three quarters in height, and the whole of them preserved nearly the same proportions from base to apex. There was also more or less of the appearance of a suture, running nearly the whole length of

the sponge, from the proximal to the distal extremity, and occasionally there were short portions of its length which were not entirely closed.

These sutures appear to me to be the results of the parasitical habit of the species, as in one of them I found the remains of a tubular, horny Zoophyte at the base, and at very near the apex of the sponge, immediately on the line of the longitudinal suture, evidently extending from the base to the point near the apex where the Zoophyte emerged from the sponge, and in another specimen small portions of the included bodies projected occasionally from its surface, but were broken close off, apparently after the sponge had been dried.

In two of the specimens also the impressions of the included Fuci or Zoophytes were distinctly apparent on the surface of the sponges. Mr. Bean has also a series of specimens similar to those I have described, which were obtained from Mr. Cullen, who informed me that the whole of them were dredged by the trawlers at the Dogger Bank, from which locality it is very probable that the type specimen of *Halichondria virgultosa* (Johnston) in Mr. Bean's cabinet was obtained.

Three of my specimens had their basal attachments perfect, and in each the substance from which they sprung was a dentalium, and in each case there was not the slightest tendency to lateral expansion of their bases ; and the general habit was evidently that of closely embracing and lapping, as it were, their supporters, entirely within their substance. Their course was directly upwards, and not the slightest disposition to branching was evinced by either of them, not even as in the one where the included horny Zoophyte emerged from its broadside.

The dermal membrane is thin and pellucid, and crowded with minute inflato-cylindrical spicula, which are thickly matted together. The inflation in these spicula is not always at the middle of the shaft ; in this respect it varies considerably, in some approaching very nearly one of the terminations of the spiculum. Although so abundant in the dermal membrane, they are of rare occurrence in the interstitial ones.

Dr. Johnston believed that this species was identical with Lamarck's *Spongia virgultosa*, but I regret that I cannot agree with him in that opinion. The learned author of the 'History of the British Sponges' states that he had seen only fragments of the species from the collection of Mr. Bean, and I feel satisfied that had he seen Mr. Bean's type sponge, and had obtained five specimens of the same species as I have, he would have entertained a different opinion on the subject. The species described by Lamarck in the second edition of 'Anim. s. Vert.' page 565, is characterised as follows:—“*S. stipite duro, erecto, ramoso; ramis subteribus, virgatis erectis, acutius culis; superficie pannea;*” and Lamarck then refers to Esper, Suppl. 2, table 66, than which nothing can well be more unlike to our sponge.

Nor does Lamarck's description at all agree with the British specimen, which has no stem, and no appearance of branches, and has no tendency to terminate acutely. On the contrary, the distal end is usually rather broader than the proximal one, and the surface of all the specimens I have seen are quite smooth, instead of being ragged, as Lamarck's sponge is said to be. Esper's figure, without reference to anatomical characters, will serve to represent numerous other similarly rameous species beside the one for which it was originally designed, and the same may be said of Lamarck's description, based entirely on external characters. I have, therefore, thought it advisable to retain the specific name *Virgultosa* for the British species, as established by Dr. Johnston.

## 27. HYMENIACIDON PLUMOSA, Bowerbank.

*SPONGIA PLUMOSA*, Montagu.  
*HALICHONDRIA PLUMOSA*, Johnston.

Sponge. Sessile, upper surface rugose and mammillated. Dermal membrane pellucid, furnished with flat fasciculi of large acerate spicula; and minute dentato-palmate angulated anchorate, retentive spicula; occasionally arranged in circular groups, and attached by

one end only. Oscula simple, large, abundant, dispersed. Pores inconspicuous. Skeleton : spicula acuate, entirely spined, stout ; and occasionally without spines. Internal defensive spicula attenuato-acuate, entirely spined. Interstitial membranes. Tension spicula like those of the dermal membrane ; and with attenuato-acuate entirely spined defensive spicula ; retentive spicula like those of dermal membrane, very abundant.

*Colour*.—Alive, scarlet ; when dried, light yellow.

*Locality*.—Coast of Devonshire, Montagu and Mrs. Griffiths.

*Examined*.—In the dried state.

The anatomical structure of this sponge is very interesting. The skeleton is exceedingly diffusive. The plumose appearance at the surface of the sponge in Montagu's type specimen is produced by the projection of a few of the terminal fasciculi of the skeleton, partially enclosed within the dermal membrane and projecting above the surface, in some cases to the extent of three or four lines ; but this is not the natural condition of the sponge. Montagu's specimen has been very much weathered, and a considerable portion of the dermal membrane has been destroyed, but fortunately for our knowledge of this species my kind friend, the late Mrs. Griffiths, of Torquay, who assiduously collected and studied the British sponges for many years, has, with her accustomed liberality, sent me the whole of her valuable collection for examination, and among them there are three specimens in a fine state of preservation, having the surface thickly studded with mammillated elevations, which are entirely enclosed by the dermal membrane, and which therefore do not possess the plumose character, whence the name is derived by Montagu.

The dermal membrane is pellucid, and is, comparatively, of considerable thickness, and very similar to the general mass of the interstitial membranes. It is abundantly furnished with flat bundles of numerous large acerate

spicula, without spines, and with a considerable number of dispersed minute angulated dentato-palmate, anchorate, retentive spicula, which are generally attached by the middle of the back of the bow of the spiculum to the inner surface of the membrane. In one small portion of the dermal membrane the anchorate spicula were arranged in a circular group, one end of each spiculum being inserted in the inner surface of the membrane, and the remainder of the spiculum being projected from its plane at about an angle of  $45^{\circ}$ , the whole forming a beautiful rosette-shaped group, similar in appearance to the grouping of the like description of spicula in *Hymeniacidon lingua*; but although I examined many other small portions of the dermal membrane of the same specimen, I did not meet with a second case of the same mode of arrangement.

It is the first time that I have met with this singular form of spiculum, in which the bend of each of the hooks appears as if each side of the hook had been forcibly compressed towards the other, so as to form an angulated hook instead of a regularly curved one. The skeleton is rather slender, and is composed of closely packed acuate spined, and acerate unspined spicula, the latter being the same as those of the dermal membrane, but the defensive spicula of the skeleton consists of entirely spined acuate spicula, the bases being inserted about once or twice the length of the diameter of the spiculum in the membrane, and the rest of the spiculum projecting at or very near to right angles. The interstitial membranes are abundantly but irregularly furnished with the three descriptions of spicula, and are very frequently armed with the spined acuate spicula, in the same manner as the skeleton; among the spined spicula are many which are shorter and more attenuated than the others, and these appear to be truly the defensive spicula, but in this curious species both the large and the small acuate, spined spicula are projected indifferently and in great profusion from all parts of the membranes.

The third specimen sent me by Mrs. Griffiths was labelled "Scarlet Foetid Sponge." I presume, therefore, that in its living state, that is, its natural colour, it is found, according

to the same authority, "on the rocks at the lowest spring tides only."

### 28. HYMENIACIDON JECUSCULUM, *Bowerbank.*

Sponge. Coating; surface corrugated, slightly hispid. Oscula simple, dispersed: submarginated, slightly ciliated. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula acerate, long, and slender; inner surface furnished with numerous stout angulated, equi-anchorate, retentive spicula. Skeleton: spicula attenuato-acuate, basally spined, long and stout, occasionally subclavate; spines rather short and small. Internal defensive spicula attenuato-acuate, entirely spined; short, occasionally subclavate; spines large and long. External defensive spicula acerate, like those of the dermal membrane. Spicula of interstitial membranes acerate, long, and slender, sometimes flexuous, numerous. Retentive spicula, angulated, bidentate, equi-anchorate, rarely tridentate, large, and stout, exceedingly numerous,

*Colour.*—Alive, vermillion-red; dried, dark flesh-red.

*Habitat.*—Caves, Island of Harris, Hebrides; Capt. F. W. L. Thomas, R.N.

*Examined.*—In the dried state.

I am indebted to my friend Captain Thomas, of the Hydrographical Survey, for this new and interesting species, which he found on the side of a cave on the coast of the Island of Harris, at low water spring tide. In its present dried condition it is one inch and a half in length, three fourths of an inch in breadth, and four lines in thickness, and in colour and appearance very closely resembles a thin slice of sun-dried muscle of beef or mutton; but when alive, my friend states it is of a pure vermillion-red colour. The surface is irregularly corrugated, and the corrugation appears to be produced principally by the slightly elevated

state of the oscula. When examined by direct light, with a power of about 100 linear, it is seen to be minutely hispid; but it is very probable that both this character and the corrugations may not exist in the living sponge.

Although not a single osculum could be detected in an open condition, these organs were readily to be distinguished in the dried specimen by their slightly elevated and rounded margins and depressed areas, and by the projection from the inner side of the marginal ring of a delicate ciliary fringe of spicula, inclining inward at an angle of about  $90^{\circ}$ . When a thin slice of the dermal surface is mounted in Canada balsam, and examined by transmitted light with a power of 160 linear, this ciliary fringe is seen to be produced by the protrusion of the proximal ends of a converging circle of closely packed parallel spicula, of the same size and form as those of the surrounding dermal membrane; and in the central depressed area the closed membrane of the osculum, with a few retentive spicula only, on its inner surface, is to be seen. The remainder of the spicula of the dermal membrane are dispersed without any approximation to order; and its internal surface is literally crowded with retentive spicula.

The skeleton spicula are not nearly so numerous as those of the interstitial membranes. The length of the two is nearly equal, but the latter is not more than half the greatest diameter of the former. Their spination is frequently confined to very near the basal extremity, while in others it extends to about the middle of the shaft of the spiculum. The internal defensive spicula, although of the same form, are readily to be distinguished from the skeleton ones, by their smaller size, their entire spination, and by the much greater comparative size and length of their spines; both descriptions of spicula frequently appear to be subclavate at the basal extremity, but this character appears to be due rather to profuse spination than to distension of the bases of the spicula.

The interstitial membranes are profusely furnished with both tension and retentive spicula. The former are frequently congregated in loose and irregularly disposed

fasciculi, but the latter are always in a dispersed condition.

I subsequently received a second specimen of this sponge from Captain Thomas, from the same locality. He describes it as "about four inches over, and three or four lines thick ; the colour was pure vermillion, the surface smooth and shining, apparently without oscula, the substance firm and fleshy on fracture. The general appearance of the sponge when fresh is like a piece of fowl's liver."

## 29. HYMENIACIDON SUBEREA, *Bowerbank.*

*SPONGIA SUBERIA*, Montagu.

*HALICHONDRIA SUBERICA* Fleming.

*SUBEREA*, Johnston.

**Sponge.** Sessile, coating, or massive ; compact and fleshy.

Surface smooth and even, with terminations of spicula occasionally projecting through it. Oscula in young specimens often inconspicuous ; in mature ones large, simple, and few in number. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton : spicula fusiformi-spinulate, variable in size and tenuity ; gathered more or less into expanding fasciculi as they approach the surface.

**Colour.**—Alive, yellow or orange ; dried, yellow or brown.

**Locality.**—The whole of the British coasts.

**Examined.**—In the living and dried state.

A careful examination is required to distinguish accurately between this species and *H. carnosia*. In large massive specimens, or when coating shells, it may usually be safely concluded that the sponge will prove to be *H. suberea*, but when it happens to have been based on a *Dentalium*, a *Vermetus*, or some other equally ill-chosen locality, not affording it surface for basal expansion, it frequently assumes very much the pedestalled lobular form of *H. carnosia*. Nor does a microscopical examination immediately solve

the difficulty, as there is a striking similarity of form between the spicula of the two species under consideration; but although this close approximation in form exists there is so great a difference in their proportions as to render their ultimate separation distinct and certain; so much so that an experienced observer may readily determine the species by the spicula alone. The following measurements derived from the spicula of the type specimens of the two species in the Johnstonian collection in the British Museum, will best illustrate their differential characters. One of the largest spicula from *H. cariosa* measured  $\frac{1}{56}$ th inch in length, and  $\frac{1}{452}$ nd inch in diameter. An average-sized one was  $\frac{1}{8}$ th inch long, and  $\frac{1}{5000}$ th inch greatest diameter, while in *H. suberea*, one of the longest spicula I could find measured  $\frac{1}{13}$ th inch in length, and  $\frac{1}{3133}$ rd inch in diameter, and an average-sized one  $\frac{1}{13}$ rd inch long, and  $\frac{1}{3777}$ th inch greatest diameter. I have examined a considerable number of specimens of each species, and I have found their proportional differences to exist in every case. In both sponges the spicula are subject to malformation and of irregularities in the development of the spinulate bases, and therefore the differences in their proportions become the more valuable as differential characters.

A favorite locality of *H. suberea* is on the shells of various species of Turbo, Fusus, and other univalves, which it often entirely envelopes, intruding itself frequently far into the interior of the shell, although it may be also occupied by a Pagurus. In a specimen assuming the form of a compressed *Hymeniacidon fucus*, and of about or rather larger than the usual size of that species, partially enveloping a shell of a Fusus, the mollusc was evidently alive at the time of the sponge locating itself, as the whole of the face of the shell, from the apex of the whorls to the extreme point of the canal for the passage of the siphuncle of the mollusc, is perfectly clear of the sponge, while the whole of the back of the shell is as completely covered by it; but notwithstanding that it does not at any part pass over the edge of the shell, it has not succeeded in gaining possession of the interior within the last whorl for nearly an inch,

there is an extremely thin layer of the sponge looking like dust within the mouth of the shell, and the angle within the shell at the junction of the outer with the inner whorl, is filled up to the breadth of about a line, and the depth of half a line. From this it would appear that every minute fragment of the sarcode of the sponge, although separated from the parent mass, is capable of sustaining the life it carries with it, and of multiplying the species by even this minute mode of division.

This mode of developing itself from a univalve shell is also the habit of *H. ficus*, which is by no means uncommon, from the north-eastern coasts of England. There is one of this description, based on the shell of a *Fucus*, that is in the Museum at Newcastle-on-Tyne, which is projected in an elongated flattened form to the length of seven and a half inches, having several large lateral lobes, and not exceeding an inch in thickness at any point, each lobe having one or more oscula, the whole number of these organs being twelve or thirteen, none of them exceeding the eighth of an inch in diameter; but the difference between the two species is readily determined by the presence in *H. ficus* of the minute inflato-cylindrical, which abound on the inner surface of its dermal membrane.

In the neighbourhood of Tenby *H. suberea* is frequently brought up by the oyster-dredgers, in masses as large as a man's fist, without any appearance of shell, which has probably been entirely enclosed by the sponge; in these specimens two or three large oscula are usually found, and the sponges are generally of a rich orange colour. I also found a specimen as large as a hen's egg, attached by a broad base to the side of St. Katherine's Rock, at Tenby, between high and low water mark, showing that it is occasionally a littoral as well as a deep-sea species; but I have usually found it on dredging in from 5 to 15 fathoms.

30. *HYMENIACIDON CARNOSA*, *Bowerbank*.

*HALICHONDRIA CARNOSA*, *Johnston*.

Sponge. Sessile or pedicelled, round or fig-shaped, compact and fleshy. Surface even, minutely hispid. Oscula and pores inconspicuous. Dermal membrane aspiculous. Skeleton spicula spinulate, long and slender. External defensive spicula same as those of the skeleton; dispersed in minute divergent groups. Tension spicula spinulate, long and slender. Gemmules spherical, membranous, aspiculous.

*Colour*.—Alive, buff or yellow to red-brown.

*Locality*.—Coasts of Ireland, Weymouth Bay, J. S. Bowerbank'; Plymouth, Mr. J. H. Stewart; Durie Voe, Shetland, Bantry Bay, Rev. A. M. Norman.

*Examined*.—In the fresh and dried states.

The general description of this sponge by Dr. Johnston is accurate, with a few exceptions. That author states that "the spicula are minute, and lie principally in parallel fascicles in the animal matrix." This description of the disposition of the spicula is correct only at the immediate surface of the sponge and for the depth of two or three times the length of a spiculum; in all the rest of the mass the spicula are loosely matted together without any approach to regularity of disposition. At the surface, for the brief space I have mentioned, they are collected into short bundles, the outer terminations of which project about half the length of a spiculum in a divergent manner, so that when the surface of the sponge is examined with a power of 200 linear it presents a series of groups of radiating spicula, which are nearly equidistant, but with no appearance of pores between them, while a similar slice from the surface of *Hymeniacidon suberea* exhibits numerous pores, and the spicula projected through the surface, though congregated in bundles as in *H. carnosæ*, are not projected to so great an extent. The substance of *H. suberea* is also more dense immediately beneath the

dermal membrane, so as to give it the appearance to the eye of having a tolerably thick dermis, while in *H. carnosa* there is no such perceptible thickening at that part, and, in fact, in neither of the species is the dermal membrane readily apparent, even beneath a power of 160 linear, when sectioned at right angles to its surface.

On dividing three specimens of *H. carnosa*, which had been preserved when alive in a saturated solution of bay salt, I could not with the unassisted eye perceive any of the canals, while in a similar selection of specimens of *H. suberea* they were numerous and distinctly visible.

It is necessary to be thus particular in the description of the differential character of the two species, as in other respects they agree remarkably in their structure; thus the form and disposition of the spicula of the skeletons in *H. carnosa* and *H. suberea* are scarcely distinguishable, and the external form and general texture are frequently very like each other.

In many of the species of *Hymeniacidon* the tension spicula of the membranes are of the same form and length as those of the skeleton, but very much more slender in their proportions; the same difference appears to prevail in those of *H. carnosa*. The stout or skeleton spicula vary greatly in length, but they have their globular bases usually well developed and at the extreme end of the shaft; but occasionally, though rarely, the globular base is placed at about one or two diameters of the shaft beyond its extreme end, which then terminates hemispherically, and the spiculum becomes enorni-spinulate; but in the slender—or what we may term by analogy the spicula of the interstitial membranes—the development of the base is by no means so uniform; sometimes half of it only is produced laterally, or it terminates the spiculum in a reversed cup form, and in some cases a secondary bulb is partially formed immediately beneath the primary one, and both are frequently more or less imperfect. These variations and malformations, which arise apparently from imperfect development, prevail more or less also in many specimens of *H. suberea* that I have seen.

I have carefully examined the type specimen of Dr. Johnston's *Halichondria carnosa*, which is in the British Museum, and I find that the spicula of the skeleton, although agreeing in form with those of *H. subcreta*, are proportionally much more slender and considerably longer, but as I have entered fully into the details of these characteristic differences existing between the two species, I will not repeat them here, but refer the student to my account of them in the description of the differential characters of the two species under consideration as the best mode of discriminating them under doubtful circumstances.

I am indebted to my late friend, Mr. John Howard Stewart, of the Royal College of Surgeons, for four specimens of this species on a broken shell of *Pecten opercularis*. Two are about half an inch in diameter, one about two lines, and the fourth very little more than a line. They are all nearly globular, and completely sessile. Another specimen from the same gentleman is also sessile, the base embracing the point of a Dentalium.

In a pear-shaped specimen, ten lines in height and eight in diameter, that I received for examination from the Rev. A. M. Norman, there were an abundance of dark amber-coloured spherical vesicles, filled with round or oval molecules; the whole mass of the sponge, excepting a space about equal to the length of a skeleton spiculum below the dermal membrane, appeared to be crowded with them. They were dispersed without any approach to order, and the fully-developed ones were nearly of the same size; an average-sized one of this description measured  $\frac{1}{1000}$ th of an inch in diameter. The parietes of the vesicle consists of a simple, strong, transparent, aspiculous membrane, and each of the molecules within it appeared to have a distinct transparent membranous envelope. I could not with a linear power of nearly 600 detect a foramen in any of these vesicles, but from their structure and mode of disposition within the sponge I have no doubt of their being its reproductive gemmules.

The Rev. A. M. Norman found this species at Durie Voe, Shetland. He says: "The amount of animal matter in

this sponge is far greater than in any other species with which I am acquainted. The specimen sent is a very small one. It attains the dimensions of a good-sized apple. When alive it is of a red-brown colour, and lives on very muddy ground."

Specimens of *Hymeniacidon fucus* are often, when young, very like those of *H. carnosa*, but they may be readily distinguished by the minute inflato-cylindrical spicula which abound in their dermal membranes.

### 31. HYMENIACIDON FICUS, Bowerbank.

*HALICHONDRIA FICUS*, Johnston.

Sponge. Massive, sessile, or pedicelled, rarely coating. Oscula simple, few, and scattered. Pores inconspicuous. Dermal membrane thin, pellucid, minutely granulated, abundantly supplied with minute inflato-cylindrical spicula, irregularly dispersed. Skeleton. Spicula, spinulate and acuate, the former exceeding the latter in number. Interstitial membranes. Spicula sub-attenuato-acuate, long, slender, numerous.

*Colour*.—Alive, gray, white, or russet red.

*Habitat*.—Coast of Scotland, Mr. W. C. Peach; Coast of Northumberland, Rev. A. M. Norman; Island of Harris, Hebrides, Capt. Thomas.

*Examined*.—In the living and dried states. •

The *ficoid* type of this species has been so accurately described by Dr. Johnston, in his 'History of British Sponges,' as to leave little more to be said on that part of its history; but, like many other British species, it varies so greatly in form as to render it very difficult, if not impossible, to distinguish it by this character alone from other nearly allied species; thus, I have a little specimen which has completely covered a small univalve shell precisely after the manner of *H. suberea*, and without exhibiting the

slightest indication of either a bulb or the pedicel for one. *H. suberea* also frequently simulates the bulbous form of *H. fucus* so exactly as to render it impossible to distinguish the species of either sponge by form alone, but the characters of the spicula, seen with a power of about 200 linear, will readily settle the question.

In its most perfect state of development it has usually a short stout pedestal, and the mass of the sponge assumes the form of a compressed dried fig. I have received this species from the Island of Harris, in the Hebrides, from my friend Captain Thomas, R.N., coating evenly the greater portion of one valve of *Pecten opercularis*. He states that "when dredged it was two tenths of an inch thick, and had a russet tinge." In its dried condition its thickness scarcely exceeds that of stout writing-paper. Thus in the discrimination of this species very little dependence can be placed in form as a specific character.

The skeleton spicula of *H. fucus* are mostly acuate, but occasionally they are more or less inclined to assume a spinulate form. The dermal membrane is abundantly supplied with minute, slightly curved, cylindrical spicula, having each a bulbous inflation near the middle. The position of this inflation varies considerably; sometimes it is equidistant from the ends of the spiculum, and at others it is about a third of the length of the spiculum from one end. A power of 500 linear is required to show them well. The interstitial membranes are also more sparingly supplied with the same form of spiculum, but varying more in size than those of the dermal membrane; some of the larger ones are bluntly acerate. No oscula were apparent on any part of the surface of a wet specimen in my possession; in others, which have been dried, they are few, minute, and scattered, and very rarely attain a diameter of two or three lines. When the dermal membrane is in a fine state of preservation, it is covered with closely packed minute granules, which require a power of not less than 300 linear to be well displayed. These minute organs were also observed in the canal membranes of one of my *scoid* specimens, but I could not see them so satisfactorily in the dermal

membrane, probably in consequence of the washing it had undergone previous to being dried for the cabinet. They require a microscopic power of 300 or 400 linear to define them in a satisfactory manner when *in situ*.

The occurrence of the inflato-cylindrical spicula in the dermal membrane of this species might lead a hasty observer to imagine the specimen a variety of *H. virgulosa*, but the difference in the form of the skeleton spicula will readily distinguish them. In the latter sponge both skeleton and tension spicula are acuate, while in *H. ficus* the skeleton ones are spinulate, and the tension spicula more or less attenuated acuate. From the great size of the latter it naturally leads to the supposition that the skeleton spicula are of two forms, instead of being all spinulate.

### 32. HYMENIACIDON SULPHUREA, Bowerbank.

HALICHONDRIA SULPHUREA, Bean, MS.

Sponge. Coating, surface smooth and even. Oscula and pores inconspicuous. Dermal membrane pellucid, abundantly spiculous. Spicula spinulate, large and long, and very small, numerous, irregularly and thickly matted together. Skeleton. Spicula spinulate, stouter and shorter than those of the dermal membrane, very numerous.

*Colour*.—Dried, sulphur-yellow.

*Locality*.—Scarborough, Mr. Bean; Guernsey, Rev. A. M. Norman.

*Examined*.—In the dried state.

This sponge covers the surface of the sandstone on which it is based for about two square inches, following its irregularities, and in no part exceeding half a line in thickness when dried. A few scattered orifices were apparent with a half inch lens, probably oscula. When a portion of the dermal membrane was viewed as a transparent object, with

a power of 660 linear, it presented a remarkably imperforate appearance, the pores being rarely visible.. The dermal membrane is not a mere film, but has comparatively a considerable amount of thickness, and is thickly coated internally with spinulate spicula, closely felted, as it were, together, interspersed with which there are numerous minute ones of the same form.

The spicula of the interstitial membranes are of the same form as those of the dermal one, but somewhat stouter and shorter in their proportions, and they are not quite so numerous, although very abundant, and the minute spinulate ones are not by any means so abundant. The sarcodæ presents the appearance of a firm amber coloured jelly, of uniform consistence, when viewed with a power of 400 linear.

The specimen sent to me by my friend Mr. Bean, was labelled *Halichondria sulphurea*, and I have therefore adopted his very appropriate name, as in its dried condition it causes the stone which it coats to appear as if it had been washed over with a thick infusion of milk of sulphur.

The Rev. A. M. Norman subsequently sent me a specimen of this species from Guernsey, which covered part of the shell of an oyster to about the same degree of thickness as that of the type specimen, with which it also agreed in every other respect.

### 33. HYMENIACIDON SUBCLAVATA, Bowerbank.

Sponge. Coating. Surface even, smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane abundantly spiculous; spicula sub-fasciculated, fusiformi-sub-clavate, rarely acuate, slender and frequently flexuous, about as long as those of the skeleton. Skeleton: spicula fusiformi-sub-clavate, rarely purely acuate, stout, and moderately long.. Retentive spicula, contort bihamate, large and slender, very numerous, and bidentate inequi-anchorate, very minute; and rarely dentato-palmate inequi-anchorate.

*Colour.*—Alive, pale flesh-red; dried, dull buff-yellow.

*Habitat.*—Tenby, on oyster-shells and stones.

*Examined.*—Alive and dried.

This species is by no means uncommon on the shells of the large oysters dredged at Tenby, frequently extending over the whole surface of the valve, but rarely exceeding three or four lines in thickness. The oscula in many of the living sponges were not visible, but in some of the dried specimens they were readily seen by the assistance of a lens of two inches focus; the largest observed did not exceed about a line in diameter. In the dermal membrane there is a manifest tendency to fasciculation of the tension spicula, but there are no symptoms of order or arrangement of these loose bundles. In both the skeleton and tension spicula there is a constant tendency to sub-clavation of the base of the spiculum, and perhaps more especially among the tension ones; but in none of them is the clavate termination strongly produced: but this tendency to dilatation of the base of the spiculum is decidedly the rule, and the occurrence of purely acuate forms the exception.

The retentive spicula are abundant, and very characteristic. The bihamate ones are large and very numerous; in a fully developed state they measured  $\frac{1}{36}$  inch in length. The bidentate anchorate ones are also rather numerous, but exceedingly minute; one of the largest of them measured  $\frac{1}{360}$  inch in length. They are perfectly invisible in the fresh tissues, and are rarely to be detected *in situ*, even by the aid of Canada balsam, and it is only by preparation in boiling nitric acid, and with a microscopic power of about 800 linear, that they can be satisfactorily defined. The occurrence of the dentato-palmate inequi-anchorate ones is rather rare. A fine specimen which I measured was  $\frac{1}{134}$  inch in length.

**34. HYMENIAOIDON CLAVIGERA, Bowerbank.**

**Sponge.** Massive, sessile? Surface uneven, deeply pitted, more or less hispid. Oscula and pores unknown. Dermal membrane thin, pellucid, spiculous; spicula same as those of the skeleton. Skeleton: spicula attenuato-clavate or spinulate, large and very long, variable in size, often more or less flexuous. Internal defensive spicula, attenuato-clavate, entirely spined, variable in size; clavate terminations mostly exaxial, frequently large and long; spines numerous, small. Sarcodæ abundant, amber coloured.

**Colour.**—Dried, light gray.

**Locality.**—Firth of Clyde, Rev. A. M. Norman.

**Examined.**—In the dried state.

This species is described from a very incomplete and unsatisfactory specimen, which is apparently a portion only of the perfect sponge; but the characters, as far as they go, are very distinct from those of any other species of the genus. The specimen is nine lines in length, and about four lines in thickness and breadth. The characters of the surface are much obscured by an abundant growth of a *Mucor*, and I could not detect either oscula or pores. In the living state it is probable that the surface would neither be deeply pitted nor hispid.

The spicula of this sponge present excellent specific characters. Those of the skeleton are spineless, and are frequently very long and slender, and they are abundantly dispersed on the interstitial membranes; they are variable in size, and often flexuous. The basal enlargement most frequently presents a more or less clavate form, but occasionally they are cylindrical. The internal defensive spicula are also exceedingly variable in length and thickness, and the clavate base is mostly exaxial, the deflexion frequently being to a very considerable extent. The spines are abun-

dantly dispersed over the whole length of the spiculum, but are very short and fine. These spicula are very numerous, and they are projected in every direction into the interstitial cavities of the sponge. I am indebted for my knowledge of this species to the Rev. A. M. Norman, of Newbottle, Co. Durham.

### 35. HYMENIACIDON CELATA, *Bowerbank.*

#### *CLIONA CELATA*, *Grant.*

- — *A. Hancock.* Annals and Mag. Nat. Hist., N. S., vol. iii, p. 332.
- *GORGONIDES*, *A. Hancock.* Ibid., p. 333.
- *GRACILIS*, *A. Hancock.* Ibid., p. 334.
- *HOWSEI*, *A. Hancock.* Ibid., p. 336.
- *NORTHUMBRICA*, *A. Hancock.* Ibid., p. 336.
- *ALDERI*, *A. Hancock.* Ibid., p. 337.
- *CORALLINOIDES*, *A. Hancock.* Ibid., p. 337.
- *LOBATA*, *A. Hancock.* Ibid., p. 341.
- *VASTIFICA*, *A. Hancock.* Ibid., p. 342.

#### *HALICHONDRIA CELATA*, *Johnston.*

Sponge. Inhabiting perforations and hollow spaces in oyster and other shells, and limestone rocks and boulders. Surface smooth. Oscula simple, or slightly elevated. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula same as those of the skeleton. Skeleton: spicula sub-fusiform-enormi-spinulate, variable in length and mode of spinulation. Sarcode abundant, yellow to dark-amber colour.

*Colour.*—Alive, yellow, or amber colour.

*Habitat.*—All parts of the coast of Great Britain in oyster and other shells, and in the limestone rocks of Tenby in abundance.

*Examined.*—In the living state.

This sponge is one of the simplest in its anatomical structure of all the British species. In the dried condition

it separates spontaneously, by contraction, from the sides of the canals which it generally inhabits, and its surface, when examined beneath the microscope, appears perfectly smooth and even. The dermal membrane, in its structure, does not appear to differ in any respect from the interstitial one, both membranes being abundantly supplied with the spicula of the skeleton.

The form of the base of the spiculum varies considerably in the same individual; some are regularly oval, others ovate, but the greater number of the adult ones are more or less enor-mi-spinulate. In some specimens the amount of variation from the normal form is greater than in others; but in none of them do the varieties exist to so great an extent as to induce us to accept them as the normal form of the sponge spiculum. The young spicula are frequently acuate, and they may be seen passing through every gradational development up to the well-produced adult enor-mi-spinulate form.

The sponge projects for about a line and half from each of the external terminations of the excavated canals, and each of these projections is furnished with an osculum. These organs have been so ably and accurately described by Dr. Grant, in the 'Edinburgh New Phil. Journal,' vol. i, p. 78, and vol. ii, p. 183, that I cannot do better than quote his description of them. "The projecting tubular papillæ possess a complicated structure and a high degree of contractile power, and exhibit a singular series of appearances when the Zoophyte is attentively examined while at rest in pure sea water. When under water, the papillæ are seen projecting from the apertures of the shell, sometimes to the length of a line and a half; they present a wide, circular opening in their centre, and a rapid current of water issues constantly from them, conveying, occasionally, flocculi of a gray, membranous matter. But on being touched with a needle, or withdrawn from the water, the opening gradually closes, the current ceases, and the whole papilla, continuing slowly to contract, is withdrawn completely within the aperture of the shell. The papillæ, viewed in their contracted state, present a smooth, rounded,

short extremity ; but when they begin to advance beyond the surface of the shell, their extremity becomes flat and slightly dilated, assumes a villous appearance, with open fissures, radiating from the centre to the margin of the papilla, and at length a minute circular opening is perceived in the centre of the villous surface. The papilla advances from the shell, and its central opening enlarges in proportion to the healthy state of the Zoophyte, and the purity and stillness of the water ; its flat, downy, radiated surface gradually diminishes by the widening of the central opening, till only thin margins are left around the orifice and the current is again seen to play briskly from it." These observations of Dr. Grant I had frequent opportunities of verifying at Tenby, and I can therefore speak with confidence as to their accuracy. In addition to the experimental touches with a needle, I tried the effect of the application, very delicately, of small drops of nitric and hydrochloric acids, but these strongly stimulating fluids did not cause the slightest contraction of the protruded portion of the sponge.

The same distinguished naturalist also states, that " during the months of March and April, when his observations were made, numerous small yellow ova were seen in the vicinity of the canals, agreeing much in their form, colour, size, and mode of distribution, with those of the *Spongia papillaris* and *S. panicea*, which were then nearly in the same stage of advancement."

Dr. Johnston, in his 'History of British Sponges,' p. 125, in his description of the specific characters, says that " the circular orifices are often filled with a mammillated plug ;" but it is not clear from which of the two varieties he has described of his *Halichondria celata* he has derived this character. I have myself found such a mammillated plug as he describes, in the surface orifices of the perforated stones at Tenby, but I have satisfied myself that it was no part of the sponge. The true oscular portion of the sponge projected from the orifices of the tubular perforations which it inhabits abound with the proper spicula of the skeleton, and no appearance of mammillæ can be detected

on any part of the dermal membrane, which is continued without fracture from the extruded portion deep into the body of the sponge, while, on the contrary, the mammillated plug spoken of by Dr. Johnston, has not a single speculum embedded in or on its membranes, and is totally detached from the neighbouring sponge tissues. It is very similar in form to the oscular portion of the sponge, but this is the only similarity that exists between them ; and it is abundantly evident that this body is simply the remains of one of the lithodomus Annelids which probably excavated the tortuous passages which have subsequently been taken possession of by the sponge. The plug consists of a circular thickened membrane with a central orifice or depression, equal to about one third of its whole diameter. Within this area there is a membrane of a deep blood-red colour. The outer portion of the surrounding membranous ring is thickly studded with mammillæ, nearly all of which are pear-shaped, the smaller end being the distal one, and the whole present every appearance of being the tentacles of an Annelid in a state of complete retraction.

The learned author of the 'History of the British Sponges' has also described two varieties of his *Halichondria celata*. The first as "massive and rude." The second as "sinuous, the shape dependent on the form of the holes in old oyster shells, which the sponge occupies and fills." The latter variety is *Cliona celata* of Grant ; the former now constitutes the type of my genus *Raphyrus*. When Dr. Johnston was writing the history of *H. celata*, he sent to me for examination, as he states in his work, "some morsels" of the sponge, requesting my opinion regarding the spicula, camera lucida drawings of which I sent to him, and which he has figured in page 127 in his work. I had not, at that time, seen a complete specimen of *Raphyrus*, and it is not, therefore, surprising that either Dr. Johnston or I should have mistaken the spicula of one species for those of the other, as their structure and proportions so closely resemble each other as to render it impossible to distinguish between the two by the normal forms of the spicula alone ; the only guide to distinction that a practised eye would find, would

be the occurrence of a few acerate spicula dispersed among those from *Raphyrds*; but when we take into consideration the anatomical peculiarities and the external forms of the two sponges, there is not a moment's hesitation required in distinguishing between them.

Mr. Hancock, of Newcastle-on-Tyne, has divided Dr. Johnston's *Halichondria celata* into twelve species, nine of which he has designated and described in the 'Annals and Magazine of Natural History,' second series, vol. iii, p. 321, but it does not appear to me that this division into species is natural or justifiable, as they are founded purely on differences in form, without any adequate variations in their structural characters to support such a division. Nearly all these proposed new species have the same habit and the same forms of spicula, with only such an amount of variation in size and form as may readily be found in a single field of view beneath the microscope, in any well-known specimen of *Halichondria celata* of Johnston when mounted in Canada balsam.

Since the publication of Mr. Hancock's paper I have examined a large number of specimens from the North Sea and various other localities, but I have failed entirely in finding one which could not be readily and justly referred to Dr. Johnston's second variety of the sponge, *Cliona celata*, Grant.

There are four of Mr. Hancock's species, *C. gracilis*, *Northumbrica*, *corallinoides*, and *vastifica*, from which he figures small acerate spicula as accompanying the spinulate ones, but he does not say from what part of the sponge he obtained them, nor what proportion they bore to the spinulate ones; but as adventitious spicula of various forms are by no means uncommon on the surface of many sponges, in their natural state, and as they are frequently firmly cemented on the dermal membrane in the same manner as grains of sand and other extraneous matters are, I must at present doubt their being the normal forms belonging to Dr. Grant's *Cliona celata*, and especially as acerate forms of spicula are so exceedingly abundant among the sandy detritus of the sea bottom. There is no British sponge

regarding which there has existed a greater diversity of opinion than the present subject of investigation, and this is, perhaps, in a great measure due to the singularity of its habit, in selecting the perforations of lithodomus annelids, and other marine animals as its habitation, and very few oyster or other shells in which such perforations exist, are free from this parasitical sponge, but it does not confine itself to the sinuous canals thus formed; if they happen to open into the bases of large parasitic Balani attached to the shell, the whole of the interior of the Balani become coated with the sponge, and in the excavated stones of Tenby it frequently entirely fills the smaller cavities, or completely coats the larger one made by the lithodomus molluscs so abundant in the surfaces of the limestone rocks between high and low water-marks in those districts.

In one specimen of the sponge in my possession, dredged by Mr. King at the Scilly Islands, in the summer of 1863, the shell, a single valve of a large Pectunculus, has the outer surface presenting the usual abundance of circular orifices, about a line and a half in diameter, from each of which the sponge is protruded in the usual manner; the inner surface of the shell, which has evidently been the one lying downward, is also furnished with numerous perforations, but as this surface has been protected by its position, the sponge has varied from its usual habit, and has spread itself evenly over the whole interior of the shell, and this surface, about two and a half inches in diameter, was perfectly smooth and glabrous, and quite destitute of oscula, as might reasonably be expected from their abundance at the outer one; the colour of this extended surface of the sponge was, in its fresh condition, of a dull ochreous yellow, and the only difference that appeared to exist between it and the parts within the substance of the shell, was that of a more abundant secretion of sarcode. This specimen exhibits the largest uninterrupted surface of the sponge I have ever seen; large cavities between the layers of old oyster shells and the interior of shells of dead Balani nearly an inch in height, completely coated by this sponge, are by no means of uncommon occurrence at Tenby, and in the

Guliot caves at Sark. Sections at right angles to the surface from the massive part of the sponge on the inner surface of the Pectunculus valve, presented all the characteristic structures that are common to the genus *Hymeniacidon*, and when compared with portions of the sponge taken from the tortuous canals in the substance of the shell the one could not be distinguished from the other.

Some naturalists have promulgated the idea that this species of sponge has the power of excavating the canals and other spaces which it usually occupies. My own intimate knowledge of the species has led me to a contrary conclusion. When located in oyster or other shells it usually fills entirely the cavities between the two surfaces, but when the canals excavated in the limestones extend to the depth of two or more inches, it frequently occurs that the sponge terminates at the depth of less than an inch, and the remaining part of the canal is quite empty and clean, without the slightest indication of having been ever occupied by sponge; and in one of these perforated stones from Tenby, which I broke through its centre, although it abounded with the sinuous canals, none of them presented the slightest traces of having ever contained sponge; and occasionally, oyster shells full of perforations may be found in the same condition, one such I have in my possession. These facts militate strongly against the idea that the excavations are produced by the sponge; and, in addition to them, we must bear in mind that the dermal membrane is quite smooth, and that there are no mechanical appliances or organs visible by which such a power of attrition could be exerted. Mr. Hancock, of Newcastle, believed that he had discovered the organs by which the sponge effected the perforations, and, with his usual kindness and liberality, he presented me with a specimen of these supposed erosive parts, which I at once recognised as cells secreting carbonate of lime, which are found in abundance embedded in the growing membranous tissues of the oyster-shells whence he had obtained his specimens. The perforation of the shells by the agent effecting that operation, would naturally liberate abundant fragments of these membranes, and the

close adherence of such portions to the dermal membrane of the sponge would be very liable to lead to the belief that they were really parts of that animal ; but if the sponge be carefully removed from the sinuous cavities of the shell and washed previously to examination, I will venture to say that no such erosive organs will ever be found embedded or organically attached to the dermal membrane of the sponge. I have often seen these cells in fragments of the membranes of the oyster-shells, but have never been able to discover any of them in conjunction with specimens of the sponge taken from the perforated bouldered limestones from the oyster beds of Tenby, or from the perforated surfaces of the limestone rocks of St. Katherine's Cave, at the same locality. In an oyster-shell from which I have thin sections, the perforations in its substance consist of nearly straight tubes of about the same diameter throughout, and each single one terminates in a round or oval cavity, varying in its diameter from three to eight or nine times the diameter of the tube ; up some of the tubes the sponge may be seen slowly winning its way, with one or two spicula disposed in a longitudinal direction, while the upper portion of the tube and the large terminal cavity is completely empty. In another part of the same specimen there is one of these large, elongo-oval cavities, from which there are four coecoid canals radiating from it of different lengths, two long and two short ; the cavity is entirely filled with the sponge, apparently from a fifth canal connected with the exterior of the shell. Now the condition of the sponge in the four coecoid canals is relatively the same, that is to say, all the parts in immediate proximity to the large cell are filled with the sponge ; the two small ones entirely so, the two long ones only partially so ; the shortest of the two long ones, for rather exceeding one third of its length, and the longest for not more than one fourth of its length. This condition of the sponge in relation to the canals and cavities in the shell unmistakably indicate that the cavities and canals were prepared previously, and that the sponge, at the time that life was arrested, was slowly winning its way into them. In the progression of the sponge up one

of these narrow tubes near its base, one or two spicula may be seen, but frequently for a considerable distance from the last spiculum the sponge consists of sarcodite only, and in no case were any of Mr. Hancock's supposed erosive organs to be detected in conjunction with the sponge.

The inner surfaces of these cells have a peculiar character ; they are not regularly and evenly bored, but the parietes consist of numerous small concavities, which appear to have been each bored separately, so that the margin of the last one partially obliterates those of its neighbours, and their average diameter is about that of one of the leading canals ; thus it would appear that the same excavating apparatus that applied in a continuously straight direction that formed a tube, was applied in a different manner to enlarge the terminal portion of the cavity by a series of short, lateral borings, and thus to form a large cavity, into which the Annelid producing it might retire at its leisure, or making it its head-quarters, bore thence other tubes in various directions, to suit its own habits and purposes, and when these were served, and it had either retired from them or died, the excavations were taken possession of by the sponge, just as a Pagurus takes possession of a dead univalve shell. The Annelids found in the borings in the Balani at Sark, and those in the deeply-seated borings of the limestone rocks at Tenby, were distinctly different species ; the former being probably lithophagous, or perhaps more correctly, testophagous in their habits, while the former were lithodomus only.

It is well-known to naturalists that the common earth-worm passes the vegetable mould through its intestines, separating the nutrient matter incorporated with it by digestion, and ejecting the indigestible matter ; the powerful jaws of the Annelids inhabiting the various species of shells eroding their substance with great facility. The substance thus detached, abounding in animal matter, is most probably passed through their digestive organs, thus affording nutriment, and forming a safe habitation at the same time, and accounting also for the vast number of perforated shells and the comparative rarity of the annelids.

Some naturalists have conceived the idea that the perforations in the oyster-shells and in limestone rocks so constantly occupied by the sponge, and those also inhabited by lithodomus molluscs, were effected by the secretion, by the animal of carbonic or other acids. The perforation of sound hard wood by such molluscs, and that of a mass of solid Highgate resin, in the British Museum, which still contains the lithodomus shell that excavated it, could never have been effected in the sea or out of it by such agents. On the contrary of both these views, I have in my collection several specimens of large *Balani*, which I took from the sides of the rocks forming the Guliot Caves in Sark, which are perforated, in the usual manner, with numerous sinuous canals, which I found filled with the living Annelids, the dried remains of which still remain in them, and without the slightest indication of the presence of *H. celata*, and I have also found living Annelids in the deeply-seated portions of the perforations in the limestone boulders of Tenby, beyond the range of the sponge; so that I think it may be reasonably concluded, that the sponge occupies the canals and cavities in shells and stones that have been excavated by other animals, and that they have no power to excavate such residences themselves.

Such speculative views regarding the habits and powers of marine animals by inland and imaginative naturalists are very apt to mislead the young student. A little close observation and accurate description at the proper localities, is infinitely more valuable than a laborious closet treatise on such subjects.

Dr. Grant, I believe, gave no generic description of *Chona*, and, in his account of it, stated that it was polyfiferous. Dr. Johnston, after careful examination, not considering it to be a Zoophyte, referred it to its proper place in the system of arrangement of the sponges that was then received, as a *Halichondria*, and subsequently in the division of that genus into numerous others, I have referred it to the extensive genus *Hymeniacidon*. There can be no reasonable doubt that had not Dr. Grant been misled by accidental circumstances, and thereby been induced to believe

it to be a Zoophyte, he would have designated it as a Spongia.

### 36. HYMENIACIDON GELATINOSA, *Bowerbank.*

Sponge. Coating, thin, gelatinoid. Surface smooth and even. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane aspiculous. Skeleton, consisting of a few long and slender spinulate spicula, usually dispersed on a basal membrane, rarely loosely fasciculated.

*Colour.*—In spirit, dull-green.

*Habitat.*—Dourie Voe, Shetland, Rev. A. M. Norman.

*Examined.*—From the spirit.

There is very little can be said about this species. It is one of the simplest spongeous bodies I have yet seen. It consists of a slightly oval patch, about eight lines in length by six in width, and not exceeding half a line in thickness, on a thin fragment of sand-stone shale, slightly exceeding the sponge in size. In its present condition it closely resembles a drop of glue spread out on the small fragment of stone. When viewed by the aid of a lens of an inch focus the surface appears smooth and even, and the oscula, although they are all closed; are apparent, as the distal terminations of the excurrent orifices are distinctly seen through the transparent dermal membrane, which is also slightly depressed over the orifices. When a small portion of the sponge was immersed in distilled water innumerable minute globular vesicles were liberated from the sarcode, which appears to consist nearly entirely of these molecules. Small pieces, of the entire thickness of the sponge, mounted in Canada balsam, exhibited the spicula *in situ*, but they were so few in number that they were as frequently isolated as they were crossing or touching each other; they were all long and slender, but very variable in their proportions; a few were congregated in two loose fasciculi, all their bases

being at one end of them and all their apices at the other, and they were also not more than about half the length of the dispersed ones.

### 37. HYMENIACIDON PAUPERTAS, *Bowerbank.*

Sponge. Sessile, coating. Surface very irregular, strongly

- hispid. Oscula inconspicuous, simple, dispersed, minute. Pores inconspicuous. Dermal membrane pellucid, furnished abundantly with sub-fusiformi cylindrical spicula, dispersed or loosely fasciculated. Skeleton ; spicula attenuato-clavate, basally spined, large and long. External defensive spicula, same as those of the skeleton. Internal defensive spicula, attenuato-clavate, entirely spined. Retentive spicula, expando-tridentate equi-anchorate, very stout and strong. Interstitial membranes, tension spicula, same as those of the dermal membrane.

*Colour.*—Dark amber.

*Habitat.*—Shetland, parasitical on Zoophytes, Rev. A. M. Norman.

*Examined.*—In the dried state.

The appearance presented by this sponge is very poor and uninviting. It coats the stem of a Zoophyte for about two inches of its length so thinly and irregularly, as at first sight to induce the idea that it is in a very early and immature stage of growth, instead of being in a completely adult state. The surface is extremely cavernous and uneven, and the hispitation, which is produced by the large external defensive spicula, is very prominent ; the spicula projecting from all parts of the surface and into the cavernous depressions for nearly the whole of their length. The dermal membrane is thickly covered with either dispersed or fasciculated sub-fusiformi-cylindrical spicula ; the fasciculi are loosely gathered together into wide flat bundles, which have no regularity in their mode of disposition. In the

interstitial membranes they appeared to be more frequently dispersed than fasciculated. The form of the skeleton spicula very closely resembles those of *Hymeniacidon clavigera*, but their bulbous bases do not appear to be exaxial, as in that species. They are long and powerful, and the spination does not extend beyond the base more than about a sixth or a seventh of their whole length. The internal defensive spicula are of the same form as the skeleton ones, but they are entirely but minutely spined, and are not above one fourth or one third the length of a full-sized skeleton spiculum.

The expando-tridentate equi-anchorate spicula of the sarcodae are very characteristic of the species ; the teeth are strongly produced, and the lateral ones widely spread ; the shaft is very stout, and frequently curved to the full extent of a semicircle.

From the similarity of the skeleton spicula of this sponge to those of *H. clavigera*, the two sponges might be readily mistaken for each other, if it were not for the strikingly characteristic forms of the anchorate spicula, which do not occur in *H. clavigera*.

### 38. HYMENIACIDON DUJARDINII, *Bowerbank.*

*HALISARCA DUJARDINII*, Johnston.

Sponge. Coating, thin. Surface smooth and even, gelatinoid. Oscula and pores inconspicuous. Dermal membrane abundantly covered internally with dispersed skeleton spicula. Spicula of skeleton cylindrical, long, very slender, and often flexuous. Internal defensive spicula attenuato-acuate, basally and medially spinous, large and stout; spines conical, large, and very numerous at the base.

*Colour*.—Alive, ochreous yellow to deep amber colour.

*Habitat*.—Berwick Bay, Dr. Johnston; Strangford Lough, Dr. Dickie; Scarborough, Mr. Bean and J. S. Bowerbank.

With the assistance of my friend, Mr. Bean, I found this sponge on the underside of small slabs of yellow oolitic sandstone between high- and low-water marks about two miles north of Scarborough; when fresh from the sea, it had the appearance of a thin layer of dark-amber coloured gelatine, and no oscula were visible. In the fresh state, it was scarcely a line in thickness, and, in its dried condition, it is not thicker than a sheet of writing-paper. Professor Dickie's specimen from Strangford Lough, on a shell of *Pecten opercularis*, is rather thicker, and is darker coloured than the Scarborough one.

This sponge was designated *Haliscarca*, by Dujardin, from his believing it to be destitute of spicula; and my friend, Dr. Johnston, failed to detect them in the specimens he found in Berwick Bay. I am not astonished that they eluded the observation of these eminent naturalists, as the spicula are very slender, and so completely embedded in the sarcode as to render them very difficult of detection when the sponge is in its natural condition, and it is only when a portion of it is immersed in Canada balsam, and with a power of about three hundred linear, that they are rendered distinctly visible.

The principal portion of the sponge consists of the dermal membrane, which is covered internally with irregularly dispersed skeleton spicula, amidst which solitary specimens of the defensive spicula may be observed lying in various directions. The interstitial membranes are few, very short, and crowded with spicula. The forms of the spicula are very characteristic of the species, and the defensive ones especially so.

The entire structure of the sponge is in perfect accordance with the other known species of thin coating sponges of my genus *Hymeniacidon*, amongst which I have therefore thought it advisable to place it. The genus *Haliscarca* was founded in a misapprehension of the structure of the animal. Had Dujardin been aware of the existence in its structure of membranes and spicula, such as are now shown to be abundant, he certainly would not have made a separate genus of it, but would have placed it among its

congeners; and, with English naturalists of that period, it would have been arranged among the species of *Halichondria*, and on the subsequent division of the latter, it naturally takes its place as a *Hymeniacidon*. Well founded genera should always be maintained if possible, but I do not see the necessity for scrupulously maintaining those which are so only in name, and are not so in essential character.

### 39. HYMENIACIDON BUCKLANDI, *Bowerbank.*

**Sponge.** Massive, sessile; surface minutely hispid, even. Oscula simple, dispersed. Pores inconspicuous. Dermis stout, minutely maculated; furnished abundantly with minute, entirely spined, cylindrical spicula; spines large, and obtusely terminated. Skeleton spicula; spiculated triradiate and attenuato-biangulated, large and stout. Tension spicula tricurvate, few in number. Sarcode; dark purple, semi-opaque, abounding with minute, entirely spined, cylindrical spicula, like those of the dermis.

**Colour.**—Alive, external dark purple; internal, light brown.

**Habitat.**—Torquay, Dr. Battersby; Guernsey, Mrs. Buckland.

This remarkable sponge, in its dried state, very closely resembles in firmness and colour a piece of dried boiled bullock's liver. A specimen with which I have been favoured by the late Mrs. Buckland, who obtained it at Guernsey, at the extreme low-water mark, was two inches in length, and one in breadth and thickness. When a thin slice from the surface is mounted in Canada balsam, the dermis is seen to abound in small, ill-defined dark maculae, and minute, entirely spined, cylindrical spicula. If the section be mounted for examination in water, the first of these characters is but indistinctly visible, while the spicula are completely invisible, in consequence of the density and

opacity of the sarcode ; and this observation applies equally well to the interstitial structures of the interior of the sponge. The minute spicula rarely exceed  $\frac{1}{600}$ th of an inch in length, and require a linear power of about 600 to render them distinctly visible. They are profusely spinous, and the spines towards the middle of the spiculum are frequently as long as the greatest diameter of the shaft of the spiculum on which they are based.

The spicula of the skeleton of this sponge are very remarkable. The spiculated triradiate ones have the three radii applied evenly to the under surface of the dermal membrane, while the shaft or spiculate ray is projected amid the tissues beneath, at right angles to the surface of the sponge. In the biangulated spicula the two points of one angle are applied to the inner surface of the dermal membrane, and the opposite pair of points are immersed in the body of the sponge ; and this appears to be the invariable position of these spicula at the surface of the sponge ; but in the interior I could not detect any such definite arrangement, but the spicula appear to be dispersed on the tissues at such distances from each other as just to allow of their apices touching, or slightly crossing each other, and the two forms appear to be indiscriminately mixed together. Throughout the whole of the tissues we find minute entirely spined cylindrical spicula, like those of the dermis, dispersed in great abundance.

The tricurvate tension spicula of the interstitial membranes are few in number and very slender ; the central curve is distinctly produced, while the terminal ones are but very slightly so.

The two forms of skeleton spicula in this species are very similar in degree of size and stoutness, and in some positions they are not readily to be distinguished from each other, but they may always be determined by the fact, that in the spiculated triradiate form the central canals, at their junction in the middle of the spiculum, form three angles of each about  $120^{\circ}$ , and three others, which are right angles ; while those of the biangulated spiculum form four right angles only at their crossing at the centre of the spiculum.

The central canals, and the concentric layers of silex in the radii, are remarkably distinctly exhibited.

I am indebted to my friend, Dr. Battersby, for the first intimation I received of the existence of this curious and interesting species on our own coasts; he found it at Torquay, at extreme low-water mark, on the rocks of Abbey Bay, adjoining Torquay. Preserved in salt and water, it is almost as solid as a piece of boiled bullock's liver.

This sponge varies so widely from the ordinary structures of *Hymeniacidon*, that I doubt much whether it should not have been made the type of a new genus.

### *HALICHONDRIA, Fleming.*

#### SECTION \* Skeleton spicula, acerate.

1. *Halichondria panicea*, Johnston.
2. — *glabra*, Bowerbank.
3. — *angulata*, Bowerbank.
4. — *caduca*, Bowerbank.
5. — *inconspicua*, Bowerbank.
6. — *incerta*, Bowerbank.
7. — *coalita*, Johnston.
8. — *distorta*, Bowerbank.

#### SECTION \*\* Skeleton spicula, acuate.

##### *Sub-section A. Skeleton spicula, smooth.*

9. *Halichondria corrugata*, Bowerbank.
10. — *Thompsoni*, Bowerbank.
11. — *forcipis*, Bowerbank.
12. — *simplex*, Bowerbank.
13. — *subdola*, Bowerbank.

*Sub-section B, Skeleton spicula, spinous.*

- 14. *Halichondria incrustans*, Johnston.
- 15. — *candida*, Bowerbank.
- 16. — *irregularis*, Bowerbank.
- 17. — *Dickiei*, Bowerbank.
- 18. — *Pattersoni*, Bowerbank.
- 19. — *pulchella*, Bowerbank.
- 20. — *Ingalli*, Bowerbank.
- 21. — *scandens*, Bowerbank.
- 22. — *Batei*, Bowerbank.
- 23. — *granulata*, Bowerbank.
- 24. — *Hyndmani*, Bowerbank.
- 25. — *Nigricans*, Bowerbank.
- 26. — *albula*, Bowerbank.

SECTION \* \* \* *Skeleton spicula, spinulate.*

- 27. *Halichondria farinaria*, Bowerbank.
- 28. — *inornatus*, Bowerbank.

1. **HALICHONDRIA PANICEA, Johnston.****HALICHONDRIA SEVOSA, Johnston.**

**Sponge.** • Coating massive or fistulous, very variable in form, sessile; surface smooth. Oscula simple or slightly elevated; dispersed on the surface, or collected in large or small fistulous cloacæ. Pores inconspicuous, numerous. Dermal membrane simple, pellucid, abundantly spiculous; spicula either arranged in rete, or irregularly dispersed. **Skeleton:** Spicula acerate or sub-fusiformi acerate. Sarcode abundant.

**Colour.**—From light ash to yellow, orange, or green of various tints.

*Locality.*—All parts of the Coasts of Great Britain.  
*Examined.*—Alive.

The shape of this sponge varies exceedingly. In its young condition it forms a thin smooth coating, on stones or fuci, frequently not exceeding three or four lines in thickness, or it envelops the stems of small Fuci or Zoophytes, and ultimately becomes free rolling masses of every variety of shape; or if it remains adherent to its original attachment, it becomes thick and massive, or it is projected in the form of one or more thick, elevated ridges, and it is then the cock's comb sponge of Ellis. In its greatest degree of development it frequently assumes a fistulous form. In the living state the surface is smooth and even, but in the dried condition it presents a structural character by which, when once familiar to the eye, the species may be almost always easily detected; and that is a beautifully reticulated appearance of the surface when viewed by an inch lens. This character is not inherent in the dermal membrane, but is simply an impress of the reticulated skeleton of the sponge immediately beneath its surface, and is therefore a constant character, and one the like of which I do not remember to have seen in any other British species of sponge.

The oscula when on the surface are large, irregularly dispersed, sometimes perfectly simple orifices, at others thinly margined or slightly elevated, and mammæform; but when collected in fistulæ, they are always simple. The fistulæ vary much in size and form. In one little specimen collected in the Moulai Straits near Bangor, the whole sponge had assumed the form of five or six fistulæ, each about three lines in diameter, and about a quarter of an inch in height, thus very closely simulating a small specimen of *Polymastia mammillaris*. In specimens from Tenby the fistulæ are projected about an inch and half in height, and exceed half an inch in diameter; from Fowey in Cornwall I have them from my indefatigable friend Mr. Peach, exceeding six inches in length and three quarters of an inch in diameter; and in a very fine specimen from Belfast Lough, sent to me by my late friend Mr. Wm. Thompson,

the mass, nine inches by six at the base, is covered by very large fistulæ, some of which are six inches in height, while others not exceeding three inches in length have an external diameter of more than one and a quarter inches. In all these cases the inner surfaces of the fistulæ are abounding with simple oscula, while on the general surface of the sponge there is scarcely one to be seen.

The pores are frequently beautifully displayed in dried specimens of this sponge. Figure 303, Plate XIX, vol. i, represents a portion of such a specimen. The variations of their character on the surface of the same sponge is often extremely great. In one spot it will be beautifully reticulated, and the area of every one of the meshes will be occupied by several pores, while within the quarter of an inch of the reticulated part the surface will be entirely devoid of either reticulations or pores, and in this case the dermal membrane is frequently furnished with a thickly matted lining of spicula without the slightest vestige of arrangement. Dr. Johnston, in his 'History of the British Sponges,' page 147, has described a species found on the shore of the Isle of Man by the late Professor Edward Forbes, under the name of *Halichondria sevosa*. I have been unable to detect any organic difference between the type specimen now in the British Museum and the common specimens of *Halichondria panicea*; and a careful inspection of the type specimen leads me to believe that the sponge was not erect, but that it had grown coating a Fucus, or some other such substance. Upon no part of the margin is there the slightest indication of a base or attachment. The "Fatty" character described by Dr. Johnston exists only in its appearance to the eye, the texture beneath the microscope is exactly that of a young thin coating specimen of *H. panicea*, and the surface in its present state is quite smooth.

There can be no reasonable doubt that the "Sponge-like crum of bread" described by Ellis in his 'History of Corallines,' No. 2, page 80, Plate XVI, d, and that designated *H. panicea* by Dr. Johnston in his 'History of British Sponges' are identical; but the author of the latter

work is in error in considering the sponge described by Dr. Grant in the 'Edinburgh Phil. Journ.,' XIV, p. 114, as the same species as Ellis's sponge. Dr. Grant has kindly furnished me with specimens of the sponge that formed the subject of his paper, and in neither external nor internal characters does it agree with Ellis's species. I am therefore induced to believe that my friend Dr. Johnston could not have seen Dr. Grant's specimens when he wrote his 'History of the British Sponges.' Ellis's sponge has certainly a prior claim to the name of *panicea*, and the species so ably described by Dr. Grant must retain the name of *Halichondria incrassans*, under which designation it is described by Dr. Johnston, 'History of British Sponges,' page 122.

This species is quite as variable in colour as it is in form. When littoral it is most frequently yellow, orange or green; but when from five or ten fathoms in depth, it is usually ash gray or cream coloured.

I cannot do better than to refer my readers to Dr. Johnston's excellent history of this species in his work on 'British Sponges,' for the general account of this very protean sponge. The large number of species into which its different forms have been divided by various authors strongly illustrates the inutility of external form as a principal specific character in the description of the species of the Spongidae.

## 2. HALICHONDRIA GLABRA, Bowerbank.

Sponge. Coating thin. Surface smooth and glabrous. Oscula simple, very small, in dispersed groups of three to five or six in number. Pores inconspicuous. Dernal membrane translucent, furnished with an irregular network of spicula, rete frequently multi-spiculous; spicula same form and size as those of the skeleton. Skeleton. Spicula sub-fusiformi-acerate, long and slender.

*Colour.*—When dried, pale yellow.

*Locality*.—Scarborough, Mr. Bean.

*Examined*.—When dry.

This sponge coats the greater part of the surface of a piece of sandstone nearly four inches square, but does not exceed the eighth of an inch in thickness at any part, and in its dry condition it might readily be mistaken for a coating specimen of *Halichondria panicea* when only superficially examined; but the peculiar glabrous appearance of the surface readily distinguishes it from that species, and especially if a lens be used to examine it. The oscula are few in number and small, and the groups are widely dispersed. The spicula of the skeleton are half as long again as those of *H. panicea*, more slender and disposed to be flexuous, and from the condition of these organs the general texture of the interior of the sponge is coarser and more open. The dermal membrane is somewhat thicker, and the number of the pores very much fewer than in *H. panicea*, and there does not appear in the specimen examined the slightest tendency to elevation of the oscula.

### 3. HALICHONDRIA ANGULATA, *Bowerbank*.

Sponge. Massive, sessile. Surface smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane translucent, furnished with a unispiculous network; spicula acerate, same size as those of the skeleton; and also with small and very slender acerate, and sub-angulated tricurvate acerate tension spicula, rather numerous. Skeleton. Rete rather irregular, occasionally multi-spiculous; spicula acerate. Tension spicula, acerate, small and slender, and sub-angulated tricurvate acerate spicula.

*Colour*.—Dried, light gray.

*Habitat*.—Guernsey, Rev. A. M. Norman.

*Examined*.—In the dried state.

The specimen in course of description is but a fragment of the perfect sponge. It is one inch in length, half an inch broad, and four lines in thickness, and in its present state it is exceedingly friable. The dermal membrane presents excellent specific characters; the unispiculous network is irregular in its area, but uniform in its general character; the spicula forming it are not united at their apices, but they cross each other at various angles, forming triangular and quadrangular spaces, the sides of which are less in length than the spicula bounding them. When the sarcodes are well preserved, the minute acerate, and sub-angulated tricurvate acerate spicula are abundantly dispersed, the latter being much more numerous than the former. The sub-angulated spicula are remarkable in their character, the central curve in the greater portion of them is so abrupt as to frequently cause the spiculum to assume the form of a right angle, while the terminal curves are but very slightly produced; but this extreme angulation, although it obtains to a considerable extent, is not universally prevalent, and others may be found exhibiting the usual variations in form and curvature that occur among this form of spicula. The same descriptions of tension spicula occur on the interstitial membranes, but apparently not to so great an extent as on the dermal one.

The specimen described is the only one of the species I have seen. It was sent to me among the sponges dredged off Guernsey by the Rev. A. M. Norman. I do not recollect to have seen tricurvate spicula in any other sponge of the first section of *Halichondria*.

#### 4. *HALICHONDRIA CADUCA*, *Bowerbank*.

Sponge. Massive, sessile, surface rugged. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane spiculous, spicula same as those of the skeleton, dispersed, numerous, and a few acerate, very slender. Skeleton diffuse, and very irregular; spicula subfusiformi acerate, rather stout and long, rarely acuate.

Interstitial membranes thin and translucent; spicula same as those of dermal membrane, but less in number.

*Colour.*—Dried, light gray.

*Habitat.*—Tenby, Mrs. Brett. Guernsey, Rev. A. M. Norman. Scarborough, Mr. Bean.

*Examined.*—In the dried state.

The structure of this sponge is very irregular. It is composed of loosely aggregated fascicula of spicula which form a very irregular and disconnected network, and the spicula of the bundles appear to have been but very slightly cemented together with keratose structure; other spicula of the same form and size are irregularly disposed amid the network. The interstitial membranes are very thin and pellucid, and when mounted in Canada balsam are scarcely visible. The dermal membrane in adult specimens is crowded with spicula of the same size and form as those of the skeleton, with, occasionally, others of the same form, but small and slender. In the specimen found by Mrs. Brett at Tenby, there were more of the slender spicula than in the larger and probably older specimens obtained by Mr. Norman, at Guernsey, in which they were rather rare.

The type specimen in its present form is eight lines in length by six in breadth, and the same in height, but it is evidently a portion only of the original mass. Mrs. Brett, to whom I am indebted for my first acquaintance with this species, found it between high- and low-water marks on the northern side of St. Katherine's Rock, at Tenby. The colour when alive, I am informed, was the same as when dried, light gray approaching closely to white.

I have subsequently examined a second specimen collected by my late friend Mr. Ingpen, and now in the possession of the Rev. Alfred M. Norman. It agrees with the type specimen in every respect excepting in its form, which is irregular. Massive towards the middle portion with three short projecting portions, and is evidently modified in

shape by the Fucus on which it is based and which it partially envelops. A third specimen in the cabinet of Mr. Bean of Scarborough, has enveloped several small stems of a Zoophyte, and has thus assumed very much the size and branched form of a small specimen of *Dictyocylindrus rugosus*; six specimens dredged by the Rev. A. M. Norman, at Guernsey, ranged from six lines in length to an inch and a half. They were all parasitical on small Fuci, and were irregularly massive in form. It therefore appears that the species does not attain a great size.

##### 5. HALICHONDRIA INCONSPICUA, *Bowerbank.*

**Sponge.** Massive, sessile; surface rugose. Oscula simple, large. Pores inconspicuous, and not very numerous. Dermal membrane pellucid; spicula same as those of the skeleton, numerous, usually dispersed, sometimes fasciculated. Skeleton spicula acerate, stout, and rather short. Tension spicula of the interstitial membranes, acerate, slender.

**Colour.**—Dried, light gray.

**Habitat.**—Tenby, Mrs. Brett.

**Examined.**—In the dried state.

I have seen but one specimen of this sponge. It is a small mass nine lines in length, six in breadth and the same in height, the surface is nearly even, but somewhat rugged. It has one large osculum which is simple and irregular in form, its greatest diameter rather exceeded two lines; there were also two or three smaller ones, less than a line in diameter. The pores are visible by the aid of an inch lens. The greater part of the dermal spicula are irregularly dispersed, but occasionally they are collected into elongated fasciculi, simulating the appearance of fragments of primary lines of an Isodictya; but no such fasciculi appear in the mass of the sponge when a section at right angles to its surface is examined.

The acerate spicula of the skeleton are short in comparison with many other species having the same form; the tension spicula of the interstitial membranes are very little inferior in length to the skeleton spicula, but much more slender. The only species of *Halichondria* with which this sponge is likely to be confounded is *H. caduca*, but the difference in the length of their skeleton spicula readily serves to distinguish them, those of *H. inconspicua* being little more than half the length of those of *H. caduca*. I am indebted to my kind friend Mrs. Brett, of Tenby, for this new species. It was gathered between high- and low-water marks on the northern side of St. Katherine's Rock, at Tenby, and I am informed was nearly of the same colour when alive as it is in the dried state, and that while drying it emitted a smell similar to heated vinegar.

#### 6. HALICHONDRIA INCERTA, *Bowerbank.*

Sponge. Sessile, coating. Surface rough and uneven. Oscula simple, dispersed, numerous. Pores inconspicuous. Dermal membrane abundantly spiculous; spicula acerate, rather slender, dispersed, closely felted together. Skeleton irregular, retic slender, very indistinct, spicula acerate, as long, but stouter than those of the dermal membrane. Interstitial membranes, tension spicula very abundant, same as those of the dermal membranes, irregularly dispersed.

*Colour.*—Dried, sulphur yellow.

*Habitat.*—Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

This sponge entirely coats a *Balanus* about an inch in height, but does not attain a greater thickness than a line, in any part. The dermal membrane is remarkably crowded with spicula, they cross each other in every possible direction, and present the appearance of having been felted together, and this crowding of the spicula appears to obtain

in all parts alike of the dermal surface. The reticulation of the skeleton contain but very few spicula, and it is very difficult to distinguish its true characters in consequence of the extreme abundance of the tension spicula, and it is only in recently produced portions of the skeleton that its reticular skeleton can be satisfactorily observed. These peculiarities in its structure cause it very closely to simulate the organization of a *Hymeniacidon*, but the short proportions of the spicula, and the close texture of the internal cavities of the sponge, greatly induce an observer to doubt its belonging to that genus, and a more careful examination will rarely fail to identify portions of the reticulations of the skeleton. The only species in the same division of *Halichondria* with which this sponge is liable to be confounded is *H. inconspicua*, but the difference in the length and proportions of their spicula will, on a comparison, always distinguish them. Those of *H. inconspicua* is in length as five to six to those of *H. incerta*, and at the same time, although longer in the latter, they are less in diameter than those of the former.

## 7. HALICHONDRIA COALITA, *Johnston.*

SPONGIA COALITA, *Grant.*

Sponge. Sessile, irregularly latticed by rounded or compressed inosculating branches. Surface smooth. Oscula simple, dispersed, few in number. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula subfusiformi acerate, variable in length and diameter. Skeleton. Interstitial spaces rather uniform. Spicula same as those of the dermal membrane, very variable in length and diameter.

*Colour.*—Light gray.

*Habitat.*—Coast of Devon, Montagu. Frith of Forth, and Coast of Sheppey, Dr. Grant.

*Examined.*—In the dried state.

I am indebted to Dr. Grant for a fine specimen of this sponge which he found on the shingle opposite Mile-town, Sheerness, Sheppey. His description of the external characters of the species is so good that I cannot do better than quote it for the information of the reader. "When *coalita* is young, its branches are long and slender; they shoot in all directions to seek for points of attachment and adhere to, or envelop every thing they meet with, living or dead, animal, vegetable, or mineral; wherever the branches cross or touch each other, they form a perfect union; sometimes the animal spreads as a layer over an oyster shell, or covers a rock like a convoluted bush, or like the root of a *Fucus*, or forms a cement connecting into a mass all manner of shells, stones, or broken glass; sometimes it forms an irregular mass, with a perfectly smooth surface, without any point of attachment, rolling to and fro at the mercy of the waves. As it advances in life, its colour assumes a darker shade, with a tinge of brown; it becomes less smooth on the surface and loses its transparency."

The specimen represented in Plate XII, fig. 1, in Dr. Johnston's 'History of British Sponges,' and that presented to me by Dr. Grant, very closely resemble each other, so that no doubt can remain of the identity of the species.

The skeleton structure of this sponge is more uniform than that of *H. panicea*; the interspaces are very much more equalised, although in no degree symmetrical; and as a type of the acerate division of *Halichondria*, it is certainly better than *H. panicea*.

The specimen marked *Spongia coalita* in Montagu's collection of sponges in the possession of Dr. Grant is certainly *Hal. simulans* of Dr. Johnston, and not *Spongia coalita* of older authors as Montagu believed. I doubt very much that the species designated *Halichondria coalita*, by Johnston, is the same as that figured by Müller in his 'Zoologia Danica,' t. cxx, as *Spongia coalita*, and presumed by him to be the same as Ellis's *Spongia ramosa Brittanica*, which there is no question is the species designated by Johnston *Halichondria oculata*; but Esper's *Spongia sub-*

*erosa*, represented in his Sponge Tables XLI, is undoubtedly the same species as that designated *Spongia coalita* by Dr. Grant, and *Halichondria coalita* by Johnston.

### 8. HALICHONDRIA DISTORTA, *Bowerbank.*

Sponge. Branching, branches compressed, terminations hemispherical. Parasitic. Surface smooth. Oscula simple, small, numerous, dispersed. Pores inconspicuous, numerous. Dermal membrane pellucid, abundantly spiculous, reticular; spicula acerate, slender, rather short. Skeleton spicula acerate and acuate, stout, variable in proportions; interstitial membranes, tension spicula, acuate and acerate, long, straight, and somewhat slender.

*Colour*.—When dried, light gray.

*Habitat*.—Near Torbay, Mrs. Griffith. River Orwell, Dr. W. B. Clarke.

*Examined*.—In the dried state.

I have seen but two specimens of this sponge; the first was procured by Mrs. Griffith from one of the Brixham trawlers, the exact locality cannot, therefore, be given; the second one was presented to me by Dr. W. B. Clarke, of Ipswich, who dredged it in the River Orwell. Mrs. Griffith's sponge consists of a fan-shaped series of short distorted compressed branches which occasionally anastomose, and are nearly all in the same plane. The basal portion of the branches are solid and cork-like in texture; the denseness decreases gradually in proportion as we approach the termination of the axis where it is scarcely perceptible. This character does not exist to so great a degree in Dr. Clarke's specimen. The height of the first specimen is six inches, and its greatest width seven inches. Dr. Clarke's sponge is about the same height, but not so broad; in other respects it is very similar

to the first one. The base of Mrs. Griffith's sponge has been destroyed, but that of Dr. Clarke's is smooth and rounded, and has several fragments of *Sertularia* projecting from it, and these Zoophytes are continued through its whole length, and are seen projecting from the terminations of several of its branches. A small *Buccinum* is partially imbedded in the basal portion of the sponge, but its true habit appears to be parasitic, surrounding Zoophytes or other branching bodies. Both specimens are inelegant and distorted in form.

The diameter of some of the largest of the oscula is about the tenth part of an inch, but the greater number are very much smaller in size. The pores are not visible without the aid of an inch lens; they are very numerous, and are equally dispersed over the surface of the sponge.

The dermal membrane is in fine preservation in Dr. Clarke's specimen. It is furnished with a network formed of bundles of spicula which are frequently continuous in curved lines over the breadth of five or six of the areas; they cross each other at various angles, and, as several of these elongate bundles are frequently coincident in their direction, there is an approach to a symmetrical arrangement in the network that is very remarkable and characteristic. The acerate spicula of the dermal network are slender and short in comparison with those of the other parts of the sponge.

The acerate spicula of the skeleton are short and stout, while the acuate ones are larger and more slender in their proportions; the two forms are mingled indiscriminately in the fasciculi of the skeleton, but the acerate one is the most numerous. The tension spicula of the interstitial membranes are of the same form as those of the skeleton, but are more elongate and slender in their proportions; they are not numerous, and the acuate form prevails in number.

**9. HALICHONDRIA CORRUGATA, Bowerbank.**

Sponge. Sessile, coating or parasitical. Surface smooth, but uneven and corrugated. Oscula simple, dispersed, small. Pores inconspicuous. Dermal membrane spiculous, strongly reticulated; spicula fusiform-acuate, stout, same size as those of the skeleton. Skeleton. Reticulation stout, multispiculous; spicula fusiform-acuate, stout, and rather short. Tension spicula same as those of the skeleton, few in number. Retentive spicula simple and contort bihamate, large, few in number.

*Colour*.—Alive, blood-red; dried, light red.

*Habitat*.—Diamond Ground, off Hastings, J. S. Bowerbank. Douglass, Isle of Man, Mr. Joshua Alder. Island of Herm, near Guernsey, Rev. A. M. Norman.

*Examined*.—Alive.

I am indebted to Mr. Alder, of Newcastle-upon-Tyne, for the first specimen I had seen of this species. It is ovoid in form, the apex being the largest end. It is an inch in height, and about half an inch in diameter. Mr. Alder described the colour as red, when alive. Subsequently I obtained, at Hastings, two living specimens from the Diamond Trawling Ground. One of these enveloped a branching Zoophyte for about the length of three inches, and had a diameter of about half an inch. The surface of this specimen was uneven, and much corrugated. The other partially covered a small dead specimen of *Desmacidon* *ægagrophila*, intermixed with portions of a Zoophyte, and following the plane of the mass on which it was based; it assumed the form of an irregularly-shaped fan, an inch and a quarter in height, and two and a quarter inches in breadth, the greatest thickness not exceeding a quarter of an inch. When alive, both surfaces were smooth, and presented the appearance of a deep blood-red flesh-like sub-

stance, and when dried they exhibited a very slight amount of corrugation. In the latter condition, the surface is strongly reticulated, very closely resembling that of *Halichondria panicea*; and in this state, the pores are distinctly apparent with the aid of a two inch lens. With a microscopical power of about 100 linear, the dermal membrane is a very interesting object, with its beautifully reticulated structure, abounding in its areas with the open inhalent pores of the sponge. The oscula are small. I could not detect them readily in the living specimens; but, in the dried condition, they are apparent to the unassisted eye. The strongly reticulated multispiculous skeleton, combined with peculiarities of the dermal membrane, readily distinguish this species from others nearly resembling it in external form and colour.

#### 10. HALICHONDRIA THOMPSONI, *Bowerbank.*

Sponge. Coating, surface even. Oscula few, large, slightly elevated. Pores conspicuous. Dermal membrane, simple, pellucid, sparingly furnished with bidentate equi-anchorate retentive spicula. Skeleton. Rete diffusive; spicula sub-fusiformi-acuate, sub-flexuous. Interstitial membranes. Tension spicula acuate, long, and slender. Retentive spicula bidentate equi-anchorate.

*Colour.*—When dry, brown.

*Locality.*—Belfast, or Larne Lough.

*Examined.*—In the dry state.

The texture of this sponge, in the dried state, is firm and rigid, and the rete very open and diffusive, the sides of the network being frequently longer than the skeleton spicula, and the interstitial membranes often assuming much of the appearance of those of a *Hymeniacidon*. The spicula of the skeleton when not fully developed are usually purely acuate, but in their completely developed state they are

decidedly sub-fusiform ; and there is a general tendency to flexuousness. The tension spicula of the interstitial membranes are acuate, and very much more slender and flexuous than those of the skeleton. The retentive spicula are minute, they require a linear power of about 600 to define their proportions well ; the dentæ are long, and their apices are slightly exflected, and they mostly appear to be attached firmly to the membranes by the middle of the back of the shaft of the spiculum.

The specimen described covers the surface of one valve of *Pecten opercularis* for about a quarter of an inch in thickness ; it formed part of the collection of the late Mr. William Thompson, of Belfast ; it is now in the museum of that town, and I have dedicated the species to him, in commemoration of the valuable services he has rendered to science by his ardent pursuit of natural history, and the liberality with which he always placed both his specimens and his knowledge at the service of his brother naturalists.

## 11. HALICHONDRIA FORCIPIS, *Bowerbank.*

Sponge. Massive, sessile. Surface uneven, smooth. Oscula simple, dispersed, rather small. Pores inconspicuous. Dermal membrane spiculous. Tension spicula sub-clavated cylindrical, dispersed or congregated in loose fasciculi ; retentive spiculi bi- and tridentate equi-anchorate, large and stout, and bidentate equi-anchorate spicula very minute, also bihamate, simple and contort, very minute and numerous. Skeleton. Rete multispiculose. Spicula acuate, stout, and rather long. Interstitial membranes abundantly and variously spiculous. Tension spicula sub-clavated cylindrical, dispersed or congregated in loose fasciculi, also forcepiform spicula entirely incipiently spined, shafts of equal or unequal lengths, dispersed or congregated in fasciculi ; retentive spicula bi- and tridentate equi-anchorate, large and stout, also bidentate equi-

anchorate, very minute, dispersed; and bihamate, simple and contort, very minute, dispersed or loosely congregated in groups.

*Colour.*—Light gray, or light brown when dry.

*Habitat.*—Shetland, Mr. C. W. Peach.

*Examined.*—In the dried state.

I received three specimens of this interesting species from my friend Mr. C. W. Peach; they were dredged at Shetland, in 1864, by Mr. J. G. Jeffreys. These specimens are irregularly massive, and are nearly of the same size, about three inches at the greatest length; neither of them exhibit evidences of a basal attachment, and, it is probable, that they were not attached to any substance at the time they were brought up by the dredge.

The dermal membranes have been very nearly destroyed, but in the small patches remaining the characteristic spicula are *in situ*, and in a good state of preservation. The oscula are simple, and rather small, and they do not appear to have been numerous. The pores were well preserved in an open state in some parts of the dermal membrane, and several were clustered together in one of the porous spaces of that organ. The reticulated skeleton is strongly and compactly formed, and the network consists of two or three spicula, or sometimes of a greater number; the areas are unequal in form, and rather indistinct in some parts. The most striking characters in this species, are those inherent in the dermal and interstitial membranes. In the latter, the sub-clavated cylindrical tension spicula are very numerous, and are frequently loosely congregated in fasciculi in greater numbers than can be counted, while others are irregularly dispersed around them. The same mode of disposition prevails with the forcepsiform spicula, and it must be remarked that the bases and the apices of the spicula forming a fasciculus are always coincident. I have never met with this form of spicula before; the nearest approximation is that of the inequi-furcato-triradiate, Figure 237, Plate X, Vol. I of this work; but in this case, there is a

long shaft projected from the semicircular base of the fork. In the spiculum of *H. forcipis* this shaft is not present. The structure of the forcepiform spiculum is very interesting; the semicircular base is much the stouter portion of it, and each limb gradually attenuates to its distal termination, ending in an extremely fine point; sometimes the limbs are equal in length, but more frequently one is considerably longer than the other. In some cases, the two run parallel to each other, but more frequently their distal extremities approach until their apices are in contact, or very nearly so. The minute spines are numerous; they extend over all parts of the spiculum, and the points of nearly all of them are inclined backward towards the semicircular base of the spiculum.

The large bi- and tridentate equi-anchorate retentive spicula are stout, and exceedingly well produced; the smaller series of bidentate ones are very minute, and the same observation applies to the bihamate spicula. For the distinct exhibition of the spination of the forcepiform spicula and the minute anchorate and bihamate ones, a linear power of 600 or 700 is required.

## 12. HALICHONDRIA SIMPLEX, *Bowerbank.*

Sponge. Parasitical, coating Zoophytes or Fuci. Surface uneven, rugged. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane profusely spiculous. Spicula same as those of the skeleton, dispersed, and frequently indistinctly fasciculated. Skeleton. Irregular and diffuse in structure; rete, spicula few in number, occasionally multispiculous; spicula acuate, long, and stout, frequently flexuous. Interstitial membrane rarely spiculous; spicula same as those of the skeleton.

*Colour.*—Light gray.

*Habitat.*—Shetland, Mr. C. W. Peach.

*Examined.*—In the dried state.

This sponge was dredged at Shetland, in 1864, by Mr. J. G. Jeffreys, and preserved for me by Mr. Peach. The specimen is irregularly fan-shaped, an inch and three quarters in height, an inch and a half at its greatest breadth, and five lines greatest thickness, and it has been firmly imbedded, apparently during its growth, by juxtaposition, in the substance of a specimen of *Halichondria inornatus*; the two sponges in their present dried condition being scarcely to be distinguished from each other, their colour and general appearance being so much alike; but a microscopical examination of a small portion of either, immediately discriminates them, *H. simplex* having the spicula acuate, while those of *H. inornatus* are spinulate.

The organization of this species is exceedingly simple; one form, only, of spicula, prevailing through all its tissues; but the large size of those organs, the open diffuse structure of the skeleton reticulations, and the somewhat coarse and profusely spiculous dermal membrane readily serve to separate it from the nearly allied species.

### 13. HALICHONDRIA SUBDOLA, *Bowerbank*.

**Sponge.** Ramose, branching irregularly. Surface even, smooth. Oscula and pores inconspicuous. Dermal membrane spiculous. Spicula acuate, minute, and slender, dispersed, very numerous. Skeleton. Rete very delicate and slender, irregular; spicula acuate, long, and slender, variable in size. .

**Colour.**—Dried, cream white.

**Habitat.**—Vazon Bay, Guernsey, Mr. Cooper.

**Examined.**—In the dried state.

This little sponge is an exceedingly deceitful subject. In its present condition it looks, at first sight, much like a branch broken off from a small *Dictyocylindrus*, but the total absence of a peripheral system and of external defensive spicula of any kind forbids our assigning it to that

genus,' notwithstanding, a rather close simulation of the structure of its skeleton. If we examine a longitudinal section in water, the comparatively large quantity of sarcode that surrounds the lines of the skeleton would seem to indicate its being a Chalina, of a very delicate structure, 'but in mounting it in Canada balsam, this simulation of fibre entirely disappears, and we find the skeleton spicula very much longer than are observable in any known species of that genus, and it also lacks the symmetrical arrangement of the parts of the skeleton of Chalina. We are, therefore, under the necessity of considering it as an abnormal form of Halichondria. The sponge consists of a single principal stem, an inch and a half in height, and rather exceeding a line in thickness, from which four small simple branches are given off in an irregular manner; three on one side a little above the middle of the parent stem, and one about half an inch from its base at right angles to the other three, the largest of these being about nine lines in length, with a diameter slightly exceeding half a line. The principal stem of the sponge has lost its natural terminations, the small branches gradually attenuate to rather acute points. From its size, colour, and structure, thus far considered, it might be imagined to be an abnormal form of *H. albescens*, but the difference in the form and size of the spicula at once forbids this conclusion. Neither oscula nor pores could be detected on any part of its surface. Nearly the whole of the dermal membrane has been destroyed; a small portion of it in a good state of preservation, was crowded with tension spicula, irregularly and closely felted together on all parts of it; the spicula differed from those of the skeleton only, in being shorter and much more slender in their proportions. The skeleton is slender and delicate in its structure; the thickest of its lines contains but few spicula, and a great number of them consists of only a single stout spiculum, coated with sarcode. The reticulation has a general tendency of the areas to elongate in the direction of the axis of the sponge, so as to have a faint resemblance to that of the axial cylinder of a *Dictyocylindrus*. There remained but very slight traces of interstitial membranes,

and in these I did not succeed in detecting any tension or other spicula.

#### 14. HALICHONDRIA INCRUSTANS, *Johnston.*

HALICHONDRIA SABURRATA, *Johnston.*  
—  
PANICEA, *Grant.*

Sponge. Sessile, massive; surface uneven. Oscula dispersed, large, simple; sometimes more or less elevated. Pores inconspicuous. Dermal membrane thin, pellucid, furnished abundantly with large flat fasciculi of cylindrical mucronate spicula, and with bihamate simple, reversed, and contort retentive spicula, and also with bi-dentate equi-anchorate spicula. Skeleton. Acuate or subfusiformi-acuate, entirely spined, stout and rather short.

*Colour.*—Buff, yellow or orange colour when alive.

*Localities.*—Frith of Forth, Dr. Grant. Hebrides, Orkneys and Shetland, Captain Thomas. Welsh and Irish Coasts, Channel Islands, Hastings, &c., J. S. Bowerbank.

*Examined.*—Alive.

- This is a very remarkable sponge, and will well repay a careful microscopical examination. The spicula of the skeleton are acuate, and occasionally sub-spinulate, more perhaps from a profusion of spines at the base than from enlargement of that extremity, and all parts of the spiculum are abundantly spinous. The dermal membrane, which can be best obtained at the sides and near the base of the sponge, is thin and transparent, and most profusely furnished with large and flattened bundles of cylindrical spicula without spines, but sometimes having their terminations more or less acute instead of hemispherical. In very young specimens the bihamate and anchorate spicula are frequently not to be detected, and the flat fasciculi of spicula on the dermal membrane are sometimes quite detached from each

other, while in mature specimens, they are frequently dispersed in parallel lines in a very regular manner, and in other cases there appears to be no order in their disposition. The variety of forms of bihamate spicula is greater than I have hitherto found in any single species, and comparatively they are large.

Of three specimens in my possession, two of them have the oscula scarcely raised above the general level, while the third has a portion of them considerably elevated on large tumid prominences.

My specimens were taken from the east side of St. Katherine's Rock at Tenby, a little above low-water spring tides. I have one from Mr. M'Andrew, who dredged it in deep water near Shetland.

This species is the one described by Dr. Grant in his admirable papers on 'The Structure and Functions of the Sponge,' under the name of *S. panicea*, in the 'Edinburgh New Phil. Journal,' i, 343, and ii, 138. Dr. Johnston, in his 'History of the British Sponges,' has placed Dr. Grant's *S. panicea* as a synonym of *H. panicea*, Johnston; but as the type of that species is the "sponge-like crum of bread" of Ellis, it is manifest that the synonym is an error. I am indebted to Dr. Grant for one of the original specimens on which he made his observations, and I am therefore enabled to make this correction safely; for although its external characters are not so strikingly developed as in the specimens from Tenby and the Hebrides, its anatomical characters are so peculiar as to leave no doubt on the subject. On examining and comparing the organization of the type specimens of *Halichondria incrassata* and *Hal. saburrata* in the Johnstonian collection of British sponges in the British Museum, I found the structural characters to be precisely identical. The author in his specific characters of the latter species, 'History of British Sponges,' p. 120, inadvertently describes the spicula as "short, curved, and double-pointed;" in page 197 of the same work he corrects this error, and describes them as "short, obtuse at one end and pointed at the other; and, in fact, so like those of *Halichondria incrassata*, as perhaps to prove that *H.*

*saburrata* may be reckoned a mere variety of the species." In this supposition I quite concur, and have therefore placed it as a synonym of *Hal. incrustans*.

Not having the advantages of a modern achromatic microscope at the time he made his investigations, my excellent friend Dr. Johnston was unable to detect the spiniferous character of the skeleton spicula, and the still more minute bihamate and anchorate ones of the dermal membrane.

Among the British sponges with which I have been favoured by the late Mrs. Griffith, there is a specimen of *H. incrustans*, which was noted as having been "scarlet but not foetid." In its dried state the colour was light-yellow, the same as it usually is when in that condition. Montague's description of this species under the designation of *Spongia fava*, 'Wernerian Memoirs,' vol. ii, p. 115, is exceedingly characteristic of its external appearances under the circumstances described.

## 15. HALICHONDRIA CANDIDA, *Bowerbank.*

**Sponge.** Massive, sessile, parasitical on small Fuci or Zoophytes. Surface even sometimes tuberous, minutely hispid. Oscula simple, dispersed, or slightly elevated. Pores inconspicuous. Dermal membrane spiculous; spicula fusiformi-acuate, smooth, or rarely incipiently spinous near the base, dispersed or diffusely fasciculated, numerous; retentive spicula contort bihamate, small and slender, few in number. Skeleton. Strongly compacted; rete multispiculose, sides of the areas rarely exceeding one spiculum in length; spicula fusiformi-acuate, short and stout, entirely spined. Interstitial membranes pellucid, spiculous; spicula same as those of the dermal membrane, very few in number; retentive spicula contort bihamate, small and slender, few in number.

**Colour.**—Alive, milk white.

*Habitat.*—Dredged off St. Martin's Point, Guernsey,  
Rev. A. M. Norman.

*Examined.*—In the dried state.

I received eight specimens of this sponge from the Rev. A. M. Norman. None of them exceeded two inches in length or an inch in height. One only had tuberculous elevations on the surface, each terminated by an osculum. In the other specimens the oscula were dispersed irregularly on the surface without elevation. The hispidation of the surface is so minute, that it is only when mounted in Canada balsam that it is apparent; it is produced by radiating fasciculi of the smooth acuate spicula of the dermal membrane, which are projected for about half their length through that organ; sometimes they spring from the skeleton reticulation beneath, but very often they are unconnected with it, and are based on the interstitial membranes only. The pores are large, and comparatively few in number. The skeleton is very compactly constructed, the rete often having as many as four or five spicula closely cemented together, and the areas are as frequently triangular as they are quadrangular. The interstitial membranes are very translucent, and the sarcode is by no means abundant. The tensio spicula are of rather rare occurrence, and the retentive spicula do not appear to be nearly so numerous as they are in the dermal membrane.

#### 16. *HALICHONDRIA IRREGULARIS*, *Bowerbank*.

Sponge. Massive, sessile; surface uneven, rugose. Oscula simple, dispersed, small. Dermal membrane pellucid, abundantly spiculous; spicula sub-fusiform acerate, large, fasciculated and sub-reticulate; and bidentate angulated equi-anchorate retentive spicula abundantly minute. Skeleton irregular and indistinctly reticulate. Spicula attenuato-acuate, basally and medially spined, stout and rather long. Internal defensive spicula attenuato-acuate, entirely spined, short and strong.

Interstitial membranes. Tension spicula sub-fusiformi-acerate, same as those of dermal membrane, dispersed. Retentive spicula bidentate angulated equi-anchorate, abundantly dispersed.

*Colour*.—Alive, ochreous-yellow, dry, brown.

*Habitat*.—Diamond Ground off Hastings, J. S. Bowerbank.

*Examined*.—In the living state.

This specimen is two and a half inches long, one and a quarter broad, and about three quarters of an inch thick. I received it among several specimens of *Halichondria incrassans* of similar size and form, and from which sponges I could not distinguish it excepting by a microscopical examination of its structure. The construction of the skeleton is very loose and irregular, and from the abundance of the large acerate tension spicula the sponge may, by a hasty examination, be easily mistaken for a *Hymeniacidon*; but its true structure is readily demonstrable when mounted in Canada balsam, by the aid of a power of about 300 linear. The skeleton spicula, and the internal defensive ones, very closely resemble each other, but the latter are very little more than half the length of the former, and although smaller, the spination stronger and more abundant than those of the skeleton, and their spination is entire from base to apex, while the apical third of those of the skeleton are usually entirely free of spines. The retentive spicula are minute, but proportionally stout, and are very abundant on all parts of the membranous tissues of the sponge.

#### 17. HALICHONDRIA DICKIEI, *Bowerbank*.

Sponge. Coating (?) ; surface smooth. Oscula simple, dispersed, small. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula mucronato-cylindrical, occasionally sub-clavate-hastate fasciculated. Skeleton spicula acuate entirely spined.

Retentive spicula bidentate and tridentate equi-anchorate, abundant and frequently very large, dispersed.

*Colour*.—When dried, deep nut-brown.

*Habitat*.—Strangford Lough, Professor Dickie.

*Examined*.—In the dried state.

I am indebted to Professor Dickie for a fragment of this species, about three quarters of an inch in diameter, and the eighth of an inch thick.

This sponge differs greatly in external appearance from *Halichondria incrassata*, although in the structure of the skeleton and in the forms of the skeleton and dermal spicula there is a close approximation to each other. The most striking difference between the two species exists in the characters of the retentive spicula. In *H. Dickiei* the anchorate spicula are very much larger and greatly exceed in number those in *H. incrassata*, and in the former there is a total absence of bihamate spicula, while in the latter species they are very numerous and various in form, so that these structural differences in addition to those of external character will enable the student to readily distinguish the two species.

The vast quantity and great size of many of the anchorate spicula is a very remarkable feature in this sponge. The inner surface of the dermal membrane is literally crowded with them, attached to the membrane by the middle of the convex surface of the curved shaft, while the terminal flukes are thrown upward into the sarcoderm. They are dispersed evenly over the whole surface of the membrane without the slightest indication of order or arrangement. They are very abundant also on the interstitial membranes, but not to so great an extent as on the dermal one. These spicula in the specimen under consideration are found in all stages of development, from the young and slender curved shaft, with scarcely an indication of the terminal flukes, to the strong and fully developed spiculum, with the flukes nearly a third of its entire length.

The tension spicula of this species present valuable differential characters, their sub-clavate or hastate termination, readily distinguish this species from the nearly allied ones of *H. incrassans* and *H. Batei*, in the tension spicula of which species, these peculiarities of termination never occur.

### 18. HALICHONDRIA PATTERSONI, *Bowerbank.*

**Sponge.** Coating (?) ; surface smooth, minutely corrugated. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous ; spicula cylindrical, incipiently terminally spined, fasciculated loosely and irregularly. Skeleton spicula acuate, entirely spined, rather stout. Retentive spicula angulated, dentato-palmate inequi-anchorate ; distal palm about half the length of the spiculum, solitary and very few in number.

**Colour.**—Nut-brown in the dried state.

**Habitat.**—Strangford Lough, Professor Dickie.

**Examined.**—In the dried state.

I am indebted to my friend Professor Dickie, of Aberdeen, for my knowledge of this species. I received from him four fragments, the largest of which was nine lines in length by four in breadth, and about one line in thickness, and there is every appearance of its having coated a flat and even surface. A few fragments only of the dermal membrane were left upon the sponge, but the positions of the oscula were distinctly indicated by the terminations of the excurrent canals at the surface of the sponge. The spicula of the skeleton are similar in form and spination to those of *H. incrassans* and *H. Dickiei*, but they are smaller by about one fourth of the length of the latter ; but the essential difference from the above-named two species exists in the incipient spination of the termination of the tension spicula, which are distinctly seen with a power of about 300 linear, and in the form of the anchorate retentive spicula, which are very few in number, and which can only

be seen *in situ* when immersed in Canada balsam, the sarcode being abundant and of a deep brown amber colour. I have named this species in honour of my friend Mr. Robert Patterson, of Belfast, whose valuable labours for the advancement of zoology are too well known to need any eulogy from me.

### 19. HALICHONDRIA PULCHELLA, *Bowerbank.*

**Sponge.** Massive, sessile; surface uneven, smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane smooth, abundantly spiculous; spicula sub-fusiformi cylindrical, terminations incipiently and very minutely spinous; dispersed or very loosely fasciculated, numerous. Tension spicula cylindrical, very long, and extremely slender, rather numerous. Retentive spicula simple bihamate, small and slender, few in number. Skeleton compact; rete multisporiculose, spicula sub-fusiformi acuate, rather stout and short, incipiently spinous. Interstitial membranes rather abundantly spiculous; tension spicula same as those of the dermal membrane; retentive spicula simple bihamate, small, and slender, very rare.

**Colour.**—Nut-brown when dried.

**Habitat.**—Guernsey, Rev. A. M. Norman.

**Examined.**—In the dried state.

The specimen has apparently been based on a small fragment of a bivalve shell, and was composed of two specimens united by a very small portion of their surfaces. The largest of the two is somewhat fan-shaped, seven lines in height, an inch in breadth, and about four lines in thickness. The form of the second specimen is very nearly the same as that of the first. The oscula are small, and require the aid of a lens of an inch focus to render them distinctly visible. The dermal membrane and its spicula afford the most prominent of the specific characters; the sub-fusiformi cylindrical spicula have their terminations

slightly dilated, and frequently exhibit very faint traces of incipient spination, requiring a linear power of about 700 to render it visible. These spicula are about the same length as those of the skeleton, but not above half or two thirds of their diameter. Their mode of disposition in the dermal membrane is very irregular; sometimes they are congregated in considerable numbers in broad flat fasciculi, in others, the bundle consists of two or three spicula only, and single spiculum are also abundantly dispersed, lying in every direction in the spaces between the fasciculi. The long slender tension spicula are faintly visible in a specimen mounted in Canada balsam; they are rather numerous, and are about equally dispersed in all parts of the membrane, but in a specimen mounted in water they are not visible. The same may be said of the retentive spicula which are very few in number. The tension spicula are so extremely attenuated that they require a power of at least 700 linear to render the form of their terminations distinctly visible; they are abundant in the interstitial membranes, while the retentive spicula are so few in number as to be very rarely detected. The spination of the skeleton spicula is by no means regular; sometimes the spines are thinly distributed over the whole of the spiculum, in others they are basally and apically spinous, and occasionally they are only basally spinous, and in all they are in so incipient a state as to be nearly invisible when immersed in the sarcode, even when mounted in Canada balsam, and it is only after being separated from the tissues by the aid of nitric acid that their characters are rendered distinctly visible.

There are only two sponges with which this species may probably be confounded, *H. Ingalli* and *H. Pattersoni*. In the former species the skeleton spicula, although of the same form are very much smaller and more slender than in *H. pulchella*, and in the latter they are much larger, and have their spination more boldly produced than in the sponge under consideration. The total absence also of anchorate spicula in *H. pulchella* serves also to render its separation more complete.

**20. HALICHONDRIA INGALLI, *Bowerbank.***

Sponge. Sessile; closely latticed by round or compressed inosculating branches. Surface uneven, slightly and minutely hispid. Oscula simple, numerous, dispersed, minute. Pores inconspicuous. Dermal membrane thin, pellucid, furnished with slender sub-fusiform cylindrical spicula which are fasciculated, forming a coarse and irregular network; and rarely with malformed bihamate, and angulated inequi-anchorate spicula. Sarcode abundant, gelatinous. Skeleton. Spicula attenuato-acuate, basally spined, and rarely attenuato-acerate, medially spined. Interstitial membranes furnished with dispersed, slender, sub-fusiform, cylindrical spicula like those of the dermal membrane.

*Colour.*—Nut-brown, alive. Dark brown when dried.

*Habitat.*—About one mile off Castle Hill, Hastings, J. S. Bowerbank, Moray Frith, Rev. Walter Gregor.

*Examined.*—Alive.

The latticed form of this sponge approaches somewhat to that of *Chalina Montaguii*, but the colour and surface characters of the two species are so different as to cause them to be readily distinguished from each other. The rough and slightly hispid character of the surface in either the fresh or dried state is apparent by the aid of a lens of an inch focus, and beneath a power of about 100 linear the latter character is seen to be produced by the protrusion beyond the surface of the dermal membrane of portions of the fasciculi of the skeleton. The larger oscula are barely to be seen by the unassisted eye, and the greater portion of them require the aid of a lens of an inch focus to render them distinctly visible. The dermal membrane is furnished abundantly with fasciculi of slender cylindrical or sub-

fusiformi-cylindrical spicula forming a coarse irregular network, and occasionally these spicula exhibit a slight tendency to clavate terminations; the malformed bihamate spicula are few in number, and the angulated inequi-anchorate ones are very rare. The sarcodes is abundant, and abounds with minute vesicles or cytoblasts and molecules of various sizes. It appears to entirely fill the interstitial spaces, and the interstitial membranes are also thickly covered by it.

The attenuato-acuate spicula of the skeleton are singular from the unusual irregularity of their form, near the basal termination, arising from the numerous and strongly produced spines with which they are thickly covered, so that in many cases that portion of the shaft has an irregular and distorted appearance. A few attenuato-acerate spicula are found intermixed with the attenuato-acuate ones, and these acerate spicula are medially but not terminally spined.

This sponge was brought up by the trawl about a mile off shore opposite to the Castle Hill. I have named it after my late friend Mr. Thomas Ingall to whom I am indebted for many interesting specimens of sponges from the British Channel, and for much kind assistance during the course of my studies of the British species.

Since writing the above, I have found a second specimen on the shore. It agrees in its external characters and size with the first one, but is less latticed in its form; when preserved in strong salt and water it becomes of a dark purple colour.

I subsequently received this sponge in a young state, in the form of a very thin dark stratum on the surface of a fragment of a large bivalve shell dredged by the Rev. Walter Gregor of Macduff, in the Moray Frith.

## 21. HALICHONCRIA SCANDENS, *Bowerbank.*

Sponge. Coating, parasitical. Surface smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal

membrane pellucid, furnished abundantly with large fusiformi-cylindrical tension spicula terminally spined, loosely fasciculated or dispersed, as long as those of the skeleton: also abundantly with simple bipocillated anchorate spicula, and sparingly with dentato-palmate and bidentate inequi-anchorate spicula. Skeleton. Spicula fusiformi-acuate, basally and apically spined, stout. Interstitial membrane. Tension spicula same as those of dermal membrane, very abundant, dispersed; also with simple bipocillated, dentato-palmate and bidentate inequi-anchorate spicula sparingly. Internal defensive spicula, acuate, entirely spined, short and stout, very few in number.

*Colour.*—Alive, vivid greenish blue. Nut-brown when dried, Rev. A. M. Norman.

*Habitat.*—Shetland, Rev. A. M. Norman.

*Examined.*—In the dried state.

This sponge is parasitical on a slender branching Zoophyte running over every part of it and coating the branches to the thickness of about a line, the entire diameter rarely appearing to exceed two lines; where the dermal membrane was preserved, the surface appeared smooth and even. The large fusiformi-cylindrical tension spicula are very abundant in some portions of the dermal membrane, frequently completely covering a considerable space, arranged in parallel order, or in broad flat fasciculi. The simple bipocillated anchorate spicula were exceedingly numerous in some parts of the inner surface of the dermal membrane and a few contort and umbonated forms were mingled with them. The pocillated anchorate spicula were many of them attached to the membrane by the middle of the back of the shaft, but the greater number were lying sideways. The interstitial membranes were very sparingly furnished with these forms. The dentato-palmate inequi-anchorate spicula are very irregular in their form. The small basal end is remarkably angular, forming nearly an equi-angular triangle, the lateral portions forming two of

the angles, and the basal tooth the third one, all three being very small, while the apical palm extended over more than half the length of the spiculum. The relative proportions of the bidentate inequi-anchorate ones are very similar to those of the palmated anchorate spicula; both sorts were attached to the dermal membrane by the external surface of the middle of the shaft, and not by the small basal end as in cases where such forms are congregated in rosette-like groups.

The skeleton spicula vary somewhat in the amount of their spination; sometimes they are only basally spined, and occasionally the middle of the shaft exhibits an incipient spination, but the general character of the spination is basally and apically. The large fusiform-cylindrical tension spicula are very abundant in the interstitial portions of the sponge, crossing the areas of the skeleton in every direction, and sometimes becoming associated with the skeleton spicula in its network. The internal defensive spicula are not half the length of the skeleton ones; their spination is complete and more prominent, especially at the base.

## 22. HALICHONDRIA BATKEI, *Bowerbank*.

Sponge. Massive, sessile. Surface smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane spiculous; spicula acuate, apices obtuse; loosely fasciculated. Skeleton. Spicula acuate, stout; entirely and profusely spined; spines minute. Retentive spicula very large; and small, bidentate equi-anchorate, rarely tridentate, very numerous.

*Colour*.—Light brown in the dried state.

*Habitat*.—Shetland? Mr. Spence Bate.

*Examined*.—In the dried state.

This sponge is a small irregular mass, seated on a piece of stone near the base of a specimen of *Isodictya* in-

*fundibuliformis*, Bowerbank, and leaning against a young specimen of *Dictyocylindrus*, Bowerbank. It is in a very imperfect condition, and does not exceed half an inch in diameter. It belongs to the museum of Natural History at Plymouth. In its structure, it is very closely allied to *Halichondria Dickiei* of this work ; but so far as we can judge by the specimen under consideration, it does not appear to be a coating sponge. In structural character, without a careful examination, it is very difficult to discriminate between them. The skeleton spicula in both species are acuate and entirely spined, but those of *Hal. Dickiei* are the more slender of the two in their proportions. The most striking specific difference exists in the tension spicula, which never present the sub-clavate or hastate terminations, which are so characteristic in those of the last-named sponge. Nor do we find the decided mucronation of both terminations as in those of *Hal. incrassans*. The tension spicula vary to some extent in their form ; occasionally, the base exhibits a slight inclination to mucronation, and sometimes the apex is so obtuse as to almost give the spiculum the character of the cylindrical form ; but the prevailing shape is that of a rather obtusely terminated acuate spiculum.

The retentive spicula, like those of *Hal. Dickiei*, are exceedingly numerous on the inner surface of the dermal membrane, as well as on the interstitial ones ; and the larger and smaller series are indiscriminately crowded together. No simple or contort biaminate spicula could be detected.

I have dedicated this species to my friend Mr. Spence Bate, who has laboured so long and so efficiently in the cause of Marine Natural History, and to whom I am indebted for my first acquaintance with this sponge.

### 23. HALICHONDRIA GRANULATA, *Bowerbank.*

Sponge. Massive, sessile. Surface somewhat rugged. Oscula simple, small, numerous, dispersed. Pores inconspicuous. Dermal membrane simple, pellucid ; furnished with sub-mucronate-cylindrical spicula, and

with large and small bidentate equi-anchorate spicula, irregularly dispersed. Skeleton. Spicula acuate, stout, entirely, but incipiently spined. Internal defensive spicula; sub-spinulate attenuato-acuate, entirely, but incipiently spined. Interstitial membranes. Tension spicula, acuate, slender, incipiently and entirely spined; and sub-mucronato-cylindrical, smooth and slender. Retentive spicula; large and small bidentate equi-anchorate spicula.

*Colour.*—In spirit, brownish red.

*Locality.*—Oban, Mr. Joshua Alder.

*Examined.*—From spirit.

I am indebted for the only specimen of this species to Mr. Joshua Alder, of Newcastle-on-Tyne, who obtained it at Oban. It is nearly hemispherical in form, and is not quite three quarters of an inch in diameter at its base. In the wet state, the surface presents a granulated appearance. The anchorate spicula on the inner surface of the dermal membrane are attached at the middle of the outer curve of the bow of the spiculum, so that both of the fluked terminations are immersed in the surface of the body of the sponge, and are equally well produced. The small acuate spined and attenuated spicula closely resemble those with which many species of fibrous sponges are armed, and which are based in those species in the fibre, and project at about right angles from it into the canals, and it is probable they perform a similar defensive office in this species; but I could not find them *in situ*, although they are tolerably abundant among the others when liberated from the animal by boiling in nitric acid. I have, therefore, assigned them to the skeleton as defensive spicula by analogy only.

The sarcode is abundant and deeply coloured, and abounds in granular molecules.

**24. HALICHONDRIA HYNDMANI, *Bowerbank.***

**Sponge.** Branching and anastomosing from numerous small attenuated bases ; branches slightly compressed, terminations corymbose. Surface rugose, hispid. Oscula and pores inconspicuous. Dermal membrane thin, transparent, furnished with a few, dispersed bidentate inequi-anchorate retentive spicula. Skeleton. Spicula attenuato-acuate, semi-spined basally, somewhat stout. Internal defensive spicula attenuato-acuate, entirely spined, few in number. Interstitial membranes. Tension spicula cylindrical, slender and flexuous ; retentive spicula bidentate inequi-anchorate, minute, dispersed ; and simple and contort bipoculated anchorate spicula, minute, dispersed. Sarcodae abundant, dense and purple in the dried state.

**Colour.**—Alive, light yellow, Rev. Walter Gregor; purple, J. S. Bowerbank. In spirit, dark purple ; when dry, brown, with a tinge of purple.

**Habitat.**—Strangford Lough, Messrs. G. C. Hyndman and Wm. Thompson. Moray Frith, Rev. W. Gregor. Hastings, J. S. Bowerbank.

**Examined.**—From spirit, alive, and dry.

This highly interesting little sponge was dredged in Strangford Lough, in June, 1846, by Messrs. Hyndman and Thompson, in from fifteen to twenty fathoms water ; it is based on the shells of *Pecten opercularis*. The largest specimen is one and three quarters inches in length by one and a quarter inches wide, and one inch in height. It was attached to the shell by a number of small basal points, but the whole by anastomosis forming one sponge. In several other smaller specimens the same peculiarities of character exist. The termination of each branch of the sponge is corymbose, and the terminations of the whole, as

regards each other, are also corymbose. The inequality in the size of the flukes of the inequi-anchorate spicula of the dermal membrane is quite as great as those in the similar membrane of *Halichondria lingua*, but they are very much fewer in number, and very minute ; and I could not detect any such symmetrical arrangement of them as exists in *H. lingua*. The internal defensive spicula are comparatively few in number ; they may be readily distinguished from those of the skeleton, from being not more than about half their length, and from being spinous from base to apex, while the distal half of those of the skeleton is without spines. The membranous interstitial structure is abundantly furnished with very minute bidentate inequi-anchorate spicula, which are not readily to be seen *in situ*, until a minute portion of the sponge has been mounted in Canada balsam, they are then seen most frequently attached to the membrane by the middle of the back of the bow of the spiculum ; they are disposed without order, and are so minute as to require a linear power of from 600 to 700, to render them visible. The varieties in the form of the bipinnulated spicula is very great, scarcely any two being precisely alike in the extent or mode of their development.

I obtained a specimen of this sponge at Hastings, thinly coating the two valves of a specimen of *Pecten opercularis*. In this form, it very closely resembles a *Hymeniacidon* in its structure, exhibiting very indistinct traces of reticulated skeleton ; but in every other organic structure it agreed perfectly with the Strangford Lough specimens. It was taken in trawling at the Diamond Fishery Ground, off Hastings, in February, 1862. Its colour was dark purple. I have also received two specimens dredged in the Moray Frith, by the Rev. Walter Gregor, of Macduff, six miles off shore, in forty-two fathoms, one of these specimens is parasitical on a small branching *Fucus*, covering it completely, and thus in its general contour closely resembles a small *Dictyocylindrus*. The other coats all parts of a small Zoophyte, confusedly matted together. The external form appears to be subject to very great variations dependent

on the substances on which the sponge may happen to be based. The specimens were labelled "Colour, light yellow."

I have dedicated this interesting species to Mr. Geo. C. Hyndman, of Belfast, who in conjunction with my late lamented friend Mr. Wm. Thompson, has done so much to diffuse a taste for Natural History in Ireland, and to whom also, I am indebted for much valuable information and assistance regarding the Irish specimens of the Spongiadæ.

### 25. HALICHONDRIA NIGRICANS, *Bowerbank.*

**Sponge.** Massive, sessile, compressed; surface uneven, somewhat rough. Oscula small, simple, numerous. Pores inconspicuous. Dermal membrane thin, pellucid; furnished with terminally spined sub-fusiform cylindrical spicula, irregularly disposed in fasciculi, and with palmato-inequi-anchorate, dentato-inequi-anchorate, and sparingly with minute inequi-bipocillated spicula. Interstitial membranes furnished with the same spicula as those of the dermal membrane. Skeleton. Spicula acuate, entirely spined, stout. Sarcode abundant, dark-coloured, abounding in compressed cytoblasts or cells.

**Colour.**—Alive and dried very dark purple.

**Habitat.**—Orkney (?) or Hebrides (?), Mr. McAndrew; Strangford Lough, Professor Dickie; Hastings, J. S. Bowerbank.

**Examined.**—In the living and dried states.

The specimen upon which this species is based is but a fragment. I found it among a large quantity of specimens of zoophytes, sponges, and other marine animals in the possession of my friend Mr. McAndrew, at Liverpool, who stated that they were part of the results of his dredgings near the Orkney Islands and the Hebrides. It is one inch

in length, half an inch in height, and rather less than a quarter of an inch thick at the lower edge, and gradually becomes thinner towards the upper edge; one end is decidedly a fractured one, the other appears to be a natural termination; the characters, therefore, of form and attachment require confirmation from more perfect specimens. The oscula are also rather indistinctly characterised, as exhibited by this mutilated specimen; they are simple, small, and irregular in form, and a few only are really conspicuous without the aid of a lens. The dermal membrane is pellucid, but the inner surface is abundantly covered with the dark-coloured sarcode.

The terminally spined sub-fusiformi-cylindrical spicula are disposed in irregular fasciculi, and from the indistinctness of the tissues, arising from the dark-coloured sarcode, they may be readily mistaken for portions of the network of the skeleton immediately beneath. The palmato- and dentato-inequianchorate and inequi-bipocillated spicula are irregularly dispersed in both the dermal and interstitial membranes; the former two did not appear in any instance to be attached to the membranes by the smaller termination, as might have been expected from their form, but in every instance observed, the attachment was at about the middle of the bow of the spiculum. It was with much difficulty that I found the inequi-bipocillated spicula *in situ* on the interstitial membranes; the larger end appeared to project slightly above the surface of the sarcode, but the line of projection was not in any one of the three I observed at right angles to the plane of the membrane. I did not detect them *in situ* in the dermal membrane, but I have no doubt that they belong to it as well as to the interstitial ones. This and *II. Hyndmani* are the only British sponges in which I have yet found this very minute and singular form of spiculum, which requires a power of 400 linear to render it distinctly visible. The dimensions of an averaged sized one which I measured was length  $\frac{1}{32}$ nd inch; diameter of largest termination  $\frac{1}{512}$ nd inch; diameter of smallest termination  $\frac{1}{512}$ rd inch, while the anchorate spicula, although small of their kind, measured in length  $\frac{1}{32}$ th inch.

The terminally spined sub-fusiform cylindrical spicula are more sparingly dispersed in the interstitial membrane than they are in the dermal one, and they are very rarely collected in fasciculi.

The compressed cyto blasts or cells of the sarcodite are abundant throughout the whole of that substance; some of them exhibited a nucleated appearance. The diameter of an average sized one that I measured was  $\frac{1}{300}$  rd inch.

I have since received this species from Professor Dickie who dredged it in Strangford Lough. This specimen coated a valve of *Pecten opercularis* for the thickness of rather more than the eighth of an inch, and I have also obtained numerous specimens coating the valves of *Pecten opercularis* from the Diamond Ground, off Hastings, the sponge in some cases being nearly three fourths of an inch in thickness, and in others not exceeding the thickness of stout paper; when in the latter state, the sponge may be readily mistaken for a *Hymeniacidon*.

## 26. HALICHONDRIA ALBULA, *Bowerbank*.

**Sponge.** Coating, very thin; surface smooth and even.

Oscula simple, dispersed. Pores inconspicuous.

Dermal membrane translucent, abundantly spiculous; spicula equally dispersed; acuate, entirely spined, large, and stout; spines conical, stout, and long. Skeleton.

Spicula, acuate, long, and slender. Spicula of interstitial membranes same as those of dermal membrane.

Retentive spicula bidentate, equi-anchorate, few in number.

**Colour.**—White, in the dried state.

**Habitat.**—Shetland; deep water, Mr. Barlee.

**Examined.**—In the dried state.

This remarkable little sponge is in the form of a very thin crust on the distal margin of the imperforated shell of a small *Terebratula caput-serpentis*, Lam. It covers a space

not exceeding two and a half lines in length by one in breadth, and it looks exceedingly like a stain of thin whitewash on the margin of the shell which does not exceed five lines in length. None of the oscula were open, but their situation was well indicated by a concentration of the dermal spicula in a radial form at particular spots on the dermal membrane, in all other parts of which the spicula were irregularly but equally dispersed. The tension spicula of the dermal and interstitial membranes are remarkably large and stout as compared with those of the skeleton, which although much longer, are not above half the diameter of the dermal ones. The skeleton in the portion examined formed but a very small part of the sponge, and was represented by a few straggling fasciculi of spicula; the sponge being, in truth, mainly composed of dermal and a few very shallow interstitial membranes with a very thin layer of skeleton fasciculi, the thickness of the whole being less than that of writing paper.

From the paucity of the skeleton in this specimen it is probable that the sponge is not an adult, and that when fully developed the reticulated skeleton would be more abundant.

I am indebted to the kindness of my late friend Mr. Barlee for this singular and interesting little species. He dredged it in deep water at Shetland.

## 27. HALICHONDRIA FARINARIA, *Bowerbank.*

Sponge. Coating, thin; surface smooth and even. Oscula numerous, simple, minute, dispersed. Pores inconspicuous. Dermal membrane pellucid, furnished abundantly with slender spinulate spicula, and more sparingly with small inflato-cylindrical tension spicula. Skeleton rete slender, areas irregular, open, and diffuse; spicula spinulate, small, and slender.

*Colour.*—Living, deep orange or scarlet. Dried, ochreous yellow.

*Habitat.*—On *Pecten opercularis*, five fathoms, Belfast Bay, Mr. William Thompson. Isle of Cumbrae, Clyde, Rev. A. M. Norman. Diamond Ground, off Hastings, J. S. Bowerbank.

*Examined.*—In the living and dried states.

The first specimen of this sponge was sent to me by my late friend, Mr. William Thompson, of Belfast, who dredged it in April, 1848, in five fathoms water, in Belfast Bay. I have received it also from the Rev. A. M. Norman. In both cases it is exceedingly thinly spread over the surface of one or both valves of *Pecten opercularis* and does not exceed half a line in thickness in any specimen that I have seen.

Mr. Thompson describes the colour of the sponge as “reddish orange when recent.” The Rev. Mr. Norman as “scarlet when living.” In four specimens I have examined in the dried state, the colour is ochreous yellow, and all of them appear as if the shells had been washed over with a thick infusion of yellow meal and then dried.

The oscula are not visible without the aid of a lens of about two inches focus, and many of them are so minute as to be scarcely discernible with that power; they are numerous, and dispersed over all parts of the sponge, I could not detect any open pores with a power of 160 linear.

The dermal membrane is furnished abundantly with spinulate spicula which are thickly matted in its inner surface; they are much shorter and more slender than those of the skeleton, a few of which are intermixed with them and closely imbedded in the same surface; there are numerous small inflato-cylindrical spicula.

I do not recollect having before found the small inflato-cylindrical spicula in any other sponge excepting *Chalina fucus*, on the dermal membrane of which they are exceedingly numerous; they are nearly of the same size in both sponges, but very much less in number in the species under consideration.

On the external surface of the sponge sent to me by

Mr. Norman, there are a number of dark oval bodies apparently ova of some Zoophyte, but I could find none of them in the substance of the sponge, nor did I observe them on the specimen from Mr. Thompson. I conclude, therefore, that they do not belong to the sponge.

I obtained numerous specimens of this sponge coating *Pecten opercularis* at Hastings, 1862. They were taken by the trawlers at the Diamond Ground, about ten miles off that town. The whole of them when alive were of a reddish orange colour; when dried, they were all of an ochreous yellow.

## 28. HALICHONDRIA INORNATUS, *Bowerbank.*

**Sponge.** Amorphous, parasitical on Zoophytes or Fuci; somewhat compressed. Surface irregular, smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane reticulated, rete very large and strong, multi-spiculate; spicula same as those of the skeleton; areas abundantly furnished with tension spicula of the same form as those of the skeleton; and also with simple and contort minute bihamate retentive spicula. Skeleton irregular and diffuse in structure; rete strong and multispiculous; spicula sub-fusiformi-spinulate, stout, and rather long. Interstitial membranes abundantly spiculous; tension spicula same as those of the skeleton; retentive spicula, simple and contort minute bihamate spicula.

**Colour.**—Dried, dirty gray.

**Habitat.**—Shetland, Mr. C. W. Peach.

**Examined.**—In the dried state.

This sponge was dredged at Shetland, in 1864, by Mr. J. Gwyn Jeffrey, and was preserved for me by Mr. Peach, who accompanied the expedition. The specimen is somewhat compressed. It is three inches in length, two inches

broad, and six lines in thickness; and when examined in the dried state with a two inch lens, the appearance is much that of a mass of tow wetted, closely compressed, and dried in that state. This appearance is produced by the large size of the reticulations of the dermal membrane, the areas of which are very open and irregular in form, and the rete very stout. The tension spicula are very abundant in the membranes of the areas, but the retentive spicula are few in number. The spicula of the rete are compactly fasciculated together. Numerous minute circular nucleated cells were imbedded in the sarcode on the inner surface of the dermal membrane. The reticulations of the skeleton are strongly and compactly constructed, but not to quite so great an extent as in the dermal membrane. The profusion and large size of the retentive spicula of the interstitial membranes frequently give the whole of that portion of the skeleton in the field of view the aspect of a *Hymeniacidon*, but the definite fasciculation of the skeleton in other parts corrects that illusion.

The retentive spicula appear to be more abundant in the interstitial membranes than in the dermal one, and the nucleated cells are as numerous in the interstitial membranes as in the dermal membrane.

On the side of this specimen is firmly imbedded the type specimen of *Halichondria simplex*; both having located themselves on the same Zoophyte, a Tubularia; they have been closely pressed together by juxtaposition and progressive development. It is a singular accident that two new species should thus be found conjoined.

ISODICTYA, *Bowerbank.*

## SECTION \* Skeleton spicula, acerate.

1. *Isodictya cinerea*, Bowerbank.
2. — *Peachii*, Bowerbank.
3. — *permollis*, Bowerbank.
4. — *simulo*, Bowerbank.
5. — *varians*, Bowerbank.
6. — *rosea*, Bowerbank.
7. — *elegans*, Bowerbank.
8. — *McAndrewii*, Bowerbank.
9. — *indefinita*, Bowerbank.
10. — *parasitica*, Bowerbank.
11. — *indistincta*, Bowerbank.
12. — *densa*, Bowerbank.
13. — *anomala*, Bowerbank.
14. — *simplex*, Bowerbank.
15. — *jugosa*, Bowerbank.
16. — *pallida*, Bowerbank.
17. — *fistulosa*, Bowerbank.
18. — *Gregorii*, Bowerbank.
19. — *fallax*, Bowerbank.
20. — *robusta*, Bowerbank.
21. — *pocillum*, Bowerbank.
22. — *mammeata*, Bowerbank.
23. — *simulans*, Bowerbank.
24. — *dichotoma*, Bowerbank.
25. — *palmata*, Bowerbank.
26. — *pygmea*, Bowerbank.
27. — *ramusculus*, Bowerbank.
28. — *clava*, Bowerbank.

## SECTION \* \* Skeleton spicula, acuate.

*Sub-section A, Skeleton spicula, smooth.*

29. *Isodictya infundibuliformis*, Bowerbank.
30. — *dissimilis*, Bowerbank.
31. — *Normani*, Bowerbank.
32. — *fucorum*, Bowerbank.
33. — *Alderi*, Bowerbank.
34. — *Edwardii*, Bowerbank.
35. — *lobata*, Bowerbank.
36. — *paupera*, Bowerbank.
37. — *uniformis*, Bowerbank.
38. — *Clarkei*, Bowerbank.
39. — *gracilis*, Bowerbank.
40. — *Barlei*, Bowerbank.

*Sub-section B, Skeleton spicula, spinous.*

41. *Isodictya Beanii*, Bowerbank.
42. — *lurida*, Bowerbank.
43. — *fimbriata*, Bowerbank.

1. **ISODICTYA CINEREA, Bowerbank.**SPONGIA CINEREA; *Grant.*HALICHONDRIA CINEREA, *Fleming.*

Johnston.

SPONGIA SOWERBII, *Fleming.*

Sponge. Coating; surface even, smooth. Dermal membrane pellucid, aspiculous. Oscula simple, dispersed, few in number. Pores inconspicuous. Skeleton unispiculous, spicula acerate, rather long and stout. Interstitial membranes. Tension spicula slender, few in number. Gemmules membranous, aspiculous.

*Colour*.—Alive, lilac colour. Rev. A. M. Norman.

Dry state, light fawn yellow.

*Habitat*.—Frith of Forth, Dr. Grant. Peterhead, Mr. Peach. Chudleigh Salterton, Rev. A. M. Norman.

*Examined*.—In the dried state.

This sponge is apparently a rare species. Dr. Grant states that he had met only with a single specimen from the Frith of Forth, and Dr. Johnston describes the specimen from which he drew up his character as containing a piece of *Zostera marina*, from which he infers it is a littoral species. I have been unable to detect the *Zostera marina* in any of the specimens at the British Museum.

In the Johnstonian collection of British sponges in the British Museum there are four small specimens arranged on one board, which are labelled *Halichondria cinerea*. Two specimens are upon one piece of card marked 17<sup>c</sup>, and the other two are respectively marked 17<sup>p</sup> and 17<sup>r</sup>. On examining each of them carefully I found them to be four distinct species of the genus *Isodictya* of this work, with two of which, one of those marked 17<sup>c</sup>, and the one marked 17<sup>p</sup>, I was previously acquainted; the remaining two specimens, one marked 17<sup>c</sup>, and the other 17<sup>r</sup>, were new to me; under these circumstances I found it was impossible to decide which of the four was the type of the sponge designated by Dr. Grant as *Spongia cinerea*. I therefore at once applied to that learned naturalist to assist me to a correct determination of the species in the event of its having been preserved in his cabinet: fortunately this was the case, and he responded to my request by kindly sending me a portion of the type specimen described in his works. On carefully comparing its structural characters with those of the four specimens marked *Halichondria cinerea* in the Johnstonian collection, I found that the one marked 17<sup>p</sup> was identical in structure with the type specimen in the cabinet of Dr. Grant.

In the dried condition of the four sponges thus exhibited in the national collection, it would be impossible to distinguish the species by the unassisted eye; but a close

inspection of their structural peculiarities enables us readily to surmount the difficulty, for although the structure of the skeletons very closely resemble each other, there are very distinct differences in the length and proportions of the spicula of which they are composed. The presence of acuate spicula in *I. varians* readily separates it from the other three, but in these the forms of the spicula are very nearly alike. Their real differential characters exist in the differences in their proportions. Thus, in *I. permollis* we have the spicula  $\frac{1}{28}$ th inch in length, and  $\frac{1}{34}$ th inch in diameter; and in *I. Peachii*  $\frac{1}{20}$ st inch long, and  $\frac{1}{14}$ rd inch in diameter; the latter agreeing nearly in length, but not having half the amount of the diameter of the former. While in *I. cinerea* the dimensions of the spicula are  $\frac{1}{16}$ th inch in length, and  $\frac{1}{28}$ th inch in diameter, agreeing nearly in diameter with those of *I. permollis*, but being almost half as long again as the spicula of that species.

The specimen sent to me by my kind friend Mr. Peach was found attached to the stalk of a large *Fucus* at Peterhead, North Britain. It is thirteen lines in length, by seven in breadth, and about two in thickness. I have also been favoured, by the Rev. A. M. Norman, with the loan of a specimen from Chudleigh Salterton, which agrees in all its essential characters with that from Mr. Peach; but it is rather the thicker of the two, and has a brighter and more decidedly yellow colour. Mr. Norman has also obtained a specimen from Seahouse, County Durham.

In one of Mr. Norman's specimens the gemmules are abundant beneath the dermal membrane, they are more or less spherical, and of a deep amber colour; one of them, apparently a full-sized and matured one, was filled with minute spherical vesicles. It measured  $\frac{1}{20}$ st inch in diameter.

## 2. ISODICTYA PEACHII, *Bowerbank.*

Sponge. Encrusting, surface smooth. Oscula simple, minute, few in number. Pores inconspicuous. Der-

mal membrane abundantly spiculous, reticulated ; rete unispicular, with numerous dispersed spicula frequently intermixed with the reticulations. Skeleton. Reticulations diffused and open or unispiculous ; spicula sub-fusiformi-acerate, small and slender. Interstitial membranes. Tension spicula, sub-fusiformi-acerate, very slender, few in number. Gemmules membranous, aspiculous.

*Colour*.—Nut-brown in the dried state.

*Habitat*.—Coast of Scotland, Mr. Peach ; Guernsey and Bantry Bay, Rev. A. M. Norman.

*Examined*.—In the dried state.

In the Johnstonian collection of British sponges in the British Museum there are four small specimens on one board, labelled *Halichondria cinerea*. Two of the specimens are upon a piece of card marked 17<sup>c</sup>, neither of which is the sponge described by Dr. Grant as *Spongea cinerea* ; the pieces are of different sizes, and represent two distinct undescribed species, the larger one being the type of our *Isodictya Peachii*. This specimen is not in a very good state of preservation, but I have fortunately obtained others from Mr. Peach and the Rev. A. M. Norman in very fine condition. The reticulations of the dermal membrane are a very beautiful object ; they are three, four, and sometimes five sided, each side being the length of a single spiculum, but the regularity and beauty of the structure is frequently obscured by the occurrence of large patches of spicula, which are irregularly dispersed over the tissue. These additions to its structure appear to be more especially above those parts to which the skeleton beneath is more strongly adherent. The skeleton is more open and diffused in its structure than is usual in that of an *Isodictya* ; the sides of the areas having two or three and sometimes more spicula in their length. The spicula of which it is composed are minute and very delicate in their proportions ; they are sub-fusiformi-acerate in form, of an average length of  $\frac{1}{16}$ th inch, and are  $\frac{1}{16}$ th inch in diameter. These proportions,

combined with the diffused structure of the skeleton, readily distinguish this species from others nearly allied to it in external characters. The gemmules are abundant immediately beneath the dermal membrane of the specimen from Bantry Bay; they are round or oval, the mature ones are filled with minute globular vesicles, which presented no appearance of a nucleus or of granular matter within, the light passing freely through their centres when viewed with a linear power of 660. The average diameter of one of the largest gemmules was  $\frac{1}{503}$ th inch in diameter, and of a perfectly globular vesicle within it  $\frac{1}{5769}$ th inch in diameter.

I have dedicated this species to my friend Mr. Peach, a most ardent and disinterested lover of natural history, to whom I am indebted for many valuable specimens of British sponges.

### 3. ISODICTYA PERMOLLIS, *Bowerbank.*

*HALICHONDRIA CINEREA*, *Johnston.*

Sponge. Encrusting, rarely massive. Surface smooth. Oscula simple or very slightly elevated. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton. Reticulations rarely more than unispiculous; spicula acerate, short and stout. Interstitial membranes. Tension spicula acerate, slender, few in number.

*Colour*.—When dried, light yellow to nut-brown.

*Habitat*.—Scarborough, Mr. Bean; Peterhead, Mr. Peach.

*Examined*.—In the dried state.

I first received this sponge from Mr. Bean, of Scarborough, who pointed it out as probably a new species of *Halichondria*. The general aspect of the species when washed and dried is somewhat like that of *H. panicea*, when thinly spread over a stone or shell, but the surface

has not the slightest trace of the peculiar reticulated appearance of that species, when examined with a lens of two inches focus. The specimens sent to me by Mr. Bean were thoroughly washed, and in that state they were of a light yellow colour, very fragile, readily compressible, and soft to the touch. I subsequently received two small specimens from Mr. Peach, which appeared to have been dried in the state in which they came from the sea, and these were of a nut-brown colour, well furnished with sarcodes, and were consequently considerably more rigid and firm to the touch. The reticulations of the skeleton are very distinct and regular; they are rarely wider or longer than the length of a single spiculum; the primary lines of the skeleton are most frequently unispicular, and the secondary ones, I believe, always so. The skeleton spicula are regularly acerate, and are short and stout in their proportions. A full-sized one measured  $\frac{1}{225}$ th inch long. The dermal membrane in all the specimens I have examined was in so dilapidated a condition as scarcely to allow of my speaking with certainty on the subject of the specific characters to be derived from it. On the board to which four specimens are attached, in the Johnstonian collection in the British Museum, and which are designated *Halichondria cinerea*, there are two on one piece of card; the smaller one is identical with our *I. pernöllis*. The mark on the card is 17<sup>c</sup>.

#### 4. ISODICTYA SIMULO, *Bowerbank.*

Sponge. Coating. Surface smooth, or rarely minutely hispid. Oscula simple, dispersed, large. Pores inconspicuous. Dermal membrane pellucid, spiculous; spicula acerate, slender, dispersed; shorter than those of the skeleton, moderately abundant. Skeleton: primary lines bi- or trispiculose; secondary lines unispiculose; spicula sub-fusiform acerate, short, and rather stout. Interstitial membranes, tension spicula, same as those of the dermal membrane; few in num-

ber. Gemmules : spherical, membranous, aspiculous.

*Colour*.—Fawn yellow.

*Habitat*.—Bantry Bay, Rev. A. M. Norman.

*Examined*.—In the dried state.

The form of the type specimen of this species is that of an irregular patch, of an average diameter of two and a quarter inches, and, in the dried state, not exceeding two lines in thickness.

The surface is slightly undulating, and appears smooth to the eye, and it is only when examined closely by the microscope that it is apparent that a few of the terminal spicula of the primary lines of the skeleton are occasionally projected beyond its plane.

The oscula were about ten in number, and varied in diameter from half a line to the tenth part of an inch.

The spicula of the dermal membrane are very little less in size than those of the skeleton. They are irregularly, but evenly dispersed. In the interstitial membranes they are similar in size and form, but fewer in number.

In the skeleton of this species the cementing keratode is in much greater quantity than I have observed in any other species of the genus with which I am acquainted, so much so as to frequently closely simulate the keratose fibre of a Chalina, but in no case have I seen it assume the decidedly cylindrical form that prevails in that genus.

Imbedded in the sarcode immediately beneath the dermal membrane, and in the other parts of the sponge, there were a considerable number of gemmules irregularly dispersed. They were spherical in form, and the adult ones varied in diameter from  $\frac{1}{1000}$ th inch to  $\frac{1}{1500}$ th inch, and there were also numerous smaller ones in a more or less undeveloped state. The adult ones were all filled with well-defined, round or oval vesicular molecules.

**5. ISODICTYA VARIANS, Bowerbank.**

• *HALICHONDRIA CINEREA*, Johnston.

**Sponge.** Encrusting. Surface smooth and even. Oscula simple, minute. Pores inconspicuous. Dermal membrane spiculous, reticulated; rete unispicular; spicula acerate, rather less in diameter than those of the skeleton. Skeleton: reticulations unispiculos, rarely exceeding the length or width of one spiculum; spicula sub-fusiformi-acerate, short and stout; with a few short and stout acuate and cylindrical ones intermixed with them. Interstitial membranes. Spicula sub-fusiformi acerate, rather slender.

**Colour.**—Light gray, in the dried state.

**Habitat.**—Shetland, Mr. Barlee.

**Examined.**—In the dried state.

This sponge is in the Johnstonian collection of British Sponges in the British Museum. It is marked 17<sup>2</sup>, and labelled *Halichondria cinerea*, and is arranged on the same board with three other species of the genus *Isodictya* of this work. It surrounds two adjoining branches of a small *Fucus*, forming two parallel and united cylinders of sponge, an inch in length and seven lines in width, and varying in thickness from one to two lines.

The dermal membrane is nearly entirely destroyed, but the reticulated structure with which it is furnished is in perfect preservation. The network is unispiculos, and the areas either four or five sided, rarely triangular, each side consisting of a single spiculum. The skeleton is very regular in its structure; the normal form of its spicula is sub-fusiformi-acerate; with these there are frequently, but irregularly combined in its structure, the abnormal acuate and short stout cylindrical spicula; they occur in both the primary and secondary portions of the network, but more

frequently in the latter than in the former position. Although tolerably abundant in the skeleton, I did not succeed in finding either of these forms in the reticular structure of the dermal membrane. The proportions of the sub-fusiformi-acerate spicula are as follows: length  $\frac{1}{25}$ th inch, diameter  $\frac{1}{25}$ rd inch.

I have not been fortunate enough to have seen any other good example of this species. On a pebble from Shetland, sent to me by the late Mr. Barlee, there is a small thin patch of the sponge not thicker than a sheet of paper, and of about three lines in diameter.

## 6. ISODICTYA ROSEA, *Bowerbank.*

Sponge. Coating. Surface uneven, minutely hispid. Oscula dispersed, large; simple, slightly elevated or subfistulous. Pores inconspicuous. Dermal membrane pellucid, very thin, aspiculous. Skeleton, slender and delicate; spicula acerate, short, and rather stout. Interstitial membranes. Spicula acerate, slender, not very abundant. Sarcode abounding in vesicular cells.

*Colour.*—Alive; delicate rose-pink.

*Locality.*—St. Katherine's Rock, Tenby; Guliot Caves, Sark; J. S. Bowerbank.

*Examined.*—Alive.

This delicate and fragile species is abundant at Tenby, in the small cave, about the middle of the north side of St. Katherine's Island. In the Guliot Caves at the Island of Sark it is rather of rare occurrence. It rarely exceeds two inches in diameter, and from a quarter to half an inch in thickness. The oscula are generally simple or slightly elevated, but occasionally they are projected as conical fistulae to the extent of nearly half an inch.

On treating a portion of the sponge with boiling nitric acid, globular vesicles were separated from the sarcode,

varying in diameter from once to five times that of the larger spicula, and from the granulated appearance of their contents, they have every appearance of being reproductive organs. These bodies are not readily to be detected in the sarcodæ, either in the living or the dead state, and they require the treatment with acid to liberate them from the surrounding sarcodæ. The structure of the skeleton is very fragile, and the number of spicula in its reticulations is very small. A full-sized spiculum measured  $\frac{1}{200}$ th inch in length.

### 7. ISODICTYA ELEGANS, *Bowerbank.*

Sponge, Sessile, parasitical; embracing the stems of Fuci or Zoophytes; branches cylindrical, fistulous. Surface smooth. Oscula simple, terminal, or slightly elevated. Pores inconspicuous. Dermal membrane furnished with a reticulation of single spicula, areas usually triangular, rarely quadrangular. Skeleton: primary and secondary lines unispiculose, very regular, slender, and delicate; spicula sub-fusiform acerate, short, and stout. Interstitial membranes. Tension spicula acerate, slender.

*Colour.*—Fawn-yellow, in the dried state.

*Habitat.*—Island of Herm, Rev. A. M. Norman.

*Examined.*—In the dried state.

The specimen which is the type of this species is unfortunately broken into four pieces, of nearly an equal size, varying from an inch and a half to nearly two inches in length; when whole it would have closely resembled in form and appearance one of the lattice-formed species of Chalina. The branches are all more or less cylindrical, and some attain a diameter of nearly half an inch; each contains a small thread-like branch of the Fucus on which it is based, and it also has an excurrent canal extending nearly the whole of its length, which terminates in an open mouth

or osculum, at the distal end of the branch; occasionally this orifice is lateral, and then its thin margin is slightly elevated above the general surface. When the branches touch each other in the course of their growth, they inosculate, and assume an irregularly latticed form. The dermal reticulation is a very beautiful object, the areas are most frequently triangular, and it often occurs that six triangles, each formed of three spicula, are packed together, an angle of each meeting the others at a central point, and their opposite basal lines forming a very regular hexagon, and this singular arrangement obtains to a considerable extent, but it is occasionally confused by the occurrence of regular or irregular quadrangular areas. The sides of the areas never appear to exceed the length of a single spiculum; and the spicula rather exceed in diameter those of the skeleton. The primary and secondary lines of the skeleton are both unispicular, and the arrangement is very regular and exceedingly delicate and beautiful, the interstices being more regularly quadrangular than is usual in an *Isodictya*. The spicula are small and equable in size, and are rather stout in proportion to their length; the tension spicula of the interstitial membranes are less in length than those of the skeleton, and very much more slender; they are not numerous, and occur in detached patches, containing three or four only.

### 8. *ISODICTYA McANDREWII*, *Bowerbank*.

Sponge. Massive, sessile, surface irregular, minutely hispid. Oscula large, fistulous. Pores inconspicuous. Dermal membrane pellucid, furnished with a uniserial network of stout acerate spicula. Skeleton. Primary lines rarely more than bi- or trispiculose, secondary lines unispiculose. Spicula acerate, stout, and short. Gemmules oval, furnished abundantly with minute acerate (?) spicula, radiating in the direction of lines from the centre to the circumference.

*Colour.*—When dried, light buff yellow.

*Habitat.*—Orkney Islands (?), Mr. McAndrew. Polperro, Rev. A. M. Norman.

*Examined.*—In the dried state.

I found this sponge amongst a miscellaneous collection of Zoophytes, sponges, and other marine animals in a large drawer full of duplicates, in the possession of my kind friend Mr. McAndrew, who informed me that they were a portion of his dredging in the neighbourhood of the Orkney Islands and the Hebrides.

The specimen is an irregularly rounded mass an inch and a half in diameter, exceedingly uneven on its surface, from the bold projections of the conical fistulous oscula, the largest of which attained a height of nearly half an inch, having an aperture of three lines in diameter. The surface of the sponge appears smooth to the unassisted eye, but when examined by transmitted light, with a power of 100 linear, it is seen to be minutely hispid, by the projection of single spicula, or groups of two or three, from the angles of the uniserial network of spicula with which the dermal membrane is furnished. The dermal membrane is thin and very pellucid, and the spicula with which it is furnished agree in size and proportions with those of the skeleton. The pores are abundant, and are barely visible by the aid of a lens of two inches focus. The interstitial membranes are rather profusely coated with sarcode which presents a firm gelatinous appearance with a power of 100 linear.

Immediately beneath the dermal membrane and attached to the angles of the uniserial network of spicula were a few gemmules apparently not in a fully developed condition; when viewed in water by transmitted light, they presented the appearance of oval masses of sarcode without any distinct investing membrane, having the points of numerous minute spicula projecting slightly beyond the surface, and a dark central nucleus of half the diameter of the gemmule. One of the most perfect measured, long diameter,  $\frac{1}{32}$ st inch, short diameter,  $\frac{1}{60}$ th inch. The spicula

were acerate in form, and were of an average length of  $\frac{1}{700}$ th inch; they were very numerous, closely packed, and radiating in the direction of lines drawn from the centre to the circumference of the gemmules. It is probable that the acerate form may not be that of the spicula of the adult gemmules, as we find in those of *Geodia* and *Pachymatisma*, that the radiating spicula of the gemmules are acerate in the imperfectly developed state, while in the fully developed condition the outer points are replaced by planes which form the bases of a series of elongated conical spicula, the united apices of which form the inner surface of the gemmule, while the united bases form a firm and even outer surface to that organ. When digested in boiling nitric acid, the gemmules entirely disappeared, and I could not find a single detached spiculum belonging to them; this result renders it the more probable that they were in an early and imperfect stage of development.

A full-sized skeleton spiculum measured  $\frac{1}{136}$ th inch in length. I have named this species in honour of my friend Mr. McAndrew, who has done so much to advance our knowledge of marine natural history, and to whom I am indebted for my knowledge of this and many other species of British and exotic sponges.

#### 9. ISODICTYA INDEFINITA, *Bowerbank.*

Sponge. Massive, sessile; surface uneven (?). Oscula simple, dispersed (?). Pores unknown. Dermal membranes aspiculous (?). Skeleton. Primary lines multispiculous; secondary lines unispiculous; rete the width of the length of the single spiculum; spicula acerate, stout. Interstitial membranes; tension spicula acerate, slender.

*Colour*.—Alive, scarlet. Dried, light brown.

*Habitat*.—Ilfracomb, Mrs. Griffith.

*Examined*.—In the dried state.

I am compelled to leave the greater part of the specific characters of this sponge in a state of uncertainty.

I received the only specimen I have seen from my kind friend the late Mrs. Griffith, labelled "scarlet when alive, Ilfracomb." In the state in which I found it, it was an amorphous mass of light brown sponge an inch and a half in length, one inch in breadth, and about two thirds of an inch in thickness. Its substance was much intermixed with small branches of Zoophytes, young shells of *Mytilus* and other extraneous matter, with scarcely any appearance of dermal membrane or well-defined oscula or pores; and it was only by the direction of the primary lines of the network of the skeleton that I could determine with certainty which was the superior surface of the sponge.

I could not detect in the few small patches of the dermal membrane remaining undecomposed any appearance of reticulated or irregularly imbedded spicula, and I have, therefore, presumed that it is aspiculous.

The structural character of the skeleton is somewhat like that of *I. anomala*, but the form of the spicula of that species at once separates them. The form of the spicula of *I. indistincta* is the same as those of *I. indefinita*, but they differ widely in their proportions, the latter being  $\frac{1}{100}$ th inch in length and stout in proportion, while the spicula of the former do not exceed  $\frac{1}{150}$ th in length, and are less in diameter in proportion to their diminished length, so that the disparity in size will always serve to distinguish the two species.

## 10. ISODICTYA PARASITICA, *Bowerbank.*

*HALICHONDRIA PARASITICA.* Johnstonian Collection, British Museum.

Sponge. Massive, sessile, parasitical on Zoophytes, &c.

Surface even, smooth. Oscula and pores inconspicuous. Dermal membrane obsolete. Skeleton diffuse and irregular; primary lines multispiculous, flexuous, and irregular; secondary lines irregular,

rarely more than unispiculous. Spicula sub-fusiformi acerate, long and slender. Interstitial membranes obsolete.

*Colour*.—In the dried state, light gray.

*Habitat*.—Dundee, Mr. Gardener.

*Examined*.—In the dried state.

Dr. Johnston, in his ‘History of British Sponges,’ page 112, in treating of *Halichondria fucorum* renders Montagu’s, Gray’s, and Grant’s species, *Spongia parasitica*; Fleming’s, Thompson’s, and Bellamy’s *Halichondria parasitica*; and Blainville’s *Halispongia parasitica*, as synonyms of his *Halichondria fucorum*, and *Hal. parasitica* holds its place in his index as a synonym only. On examining the Johnstonian collection of British sponges in the British Museum, I found five specimens labelled *Halichondria parasitica*, which are marked as follows: 47.9.7 - 142.22<sup>a</sup> — 47.9.7 - 141 - 22<sup>b</sup>. 47.9.7 — 140.22<sup>c</sup>. 47.9.7 — 137.22<sup>d</sup>, and 51.7.25 — 225.

The latter specimen is parasitical on a Sertularian Zoophyte about 6 inches in height, from Dundee, by Mr. Gardener, in the forms of five oval lobular masses, each rather less than an inch in height, with a few very much smaller pieces apparently of the same species. On examining two small sprigs of this specimen, each partially enveloped by sponge, I found they were two distinct species, neither of which belonged to the sponge described by him as *Halichondria fucorum*, which there is little doubt is the one described by Montagu in Wernerian Memoirs, ii, 114, as *Spongia parasitica*, and neither of the two specimens belonged to the genus *Halichondria*, as constituted in the present work, but both to the genus *Isodictya*, to the second division of which also belongs Johnston’s *Halichondria fucorum*. One of the two small specimens also belonged to the second or acuate division of *Isodictya*, but is a distinct species from *I. fucorum*, and is described in this work as *Isodictya Clarkei*. The other specimen belongs to the first or acerate division of the genus,

and is decidedly distinct from any of the numerous species of that division of the genus, and I have therefore thought it advisable to designate it *parasitica*, in accordance with the British Museum label 51.7.25—225. The sponge does not coat the whole of the Zoophyte from near the base to the apex without intermission, but it occurs in a series of distinct masses of irregular forms, none of them exceeding about an inch in its greatest diameter. The specimen has unfortunately been so much washed as to have destroyed the whole of its membranous structures, nor could I distinguish any satisfactory traces of oscula. The skeleton is very diffuse and irregular, but unmistakably that of an *Isodictya*. The primary lines, although sinuous and irregular in their course, are well produced, and continuously multispiculous; the irregularity of the disposition of the primary lines of the skeleton induces a corresponding effect among the secondary ones; and the whole aspect of the tissues become exceedingly confused in their appearance. Much of this confusion may probably have been the result of the excessive washing to which the sponge appears to have been subjected, for occasionally small portions of the structure present a very much more regular appearance than the principal portion does. The spicula are very characteristic of the species, they are subfusiformi-acerate, and are comparatively long and slender in their proportions; much more so than is generally the case in *Isodictya*. Imbedded in the sponge, and frequently covered irregularly with spicula, there were a considerable number of the ovarian vesicles of the Zoophyte of an oval form, and very closely resembling the ovaries in *Diplodemia*, but a microscopical examination of them when mounted in Canada balsam quickly dissipates the illusion, as the cup-shaped lid at the distal extremity of the vesicle becomes apparent by the fine circular line that marks its junction with the body of the ovarian vesicle, the lines of growth of which are apparently in accordance with its long axis, while those of the lid or cap of the vesicle are decidedly concentric, and at right angles to its long axis. The greater portion of

the ovarian vesicles of the Zoophyte were not in connection with their parent body, and on many of them so great a number of spicula had been deposited, that the illusion was very strong in these cases. The like intermixture of the ovarian vesicles with the structures of a specimen of *Isodictya Clarkei* taken from the same Zoophyte was observed; but the vesicle in this case, although detached from the Zoophyte, and immersed in the body of the sponge, had very few spicula deposited on their surface.

This curious case is instructive, as it shows us how readily we may be deceived by the common habit of the parasitical sponges of appropriating in various interesting modes the parts of the plants or Zoophytes on which they are based, to the purposes of their own development or preservation.

## 11. *ISODICTYA INDISTINCTA*, *Bowerbank*.

**Sponge.** Massive, sessile; surface smooth. Oscula simple, or more or less elevated. Pores visible, congregated in irregular areas. Dermal membrane aspiculous. **Skeleton.** Primary lines multispiculous; secondary lines unispiculous, irregular; spicula acerate, short and rather stout; rarely acuate. Interstitial membranes. Tension spicula acerate, slender, few in number.

**Colour.**—Alive, pallid ochreous yellow; dried, dark brown.

**Habitat.**—Orkney, Captain Thomas, R.N. Exmouth, Mrs. Griffiths. Guernsey, Rev. A. M. Norman. Hastings, J. S. Bowerbank.

**Examined.**—Alive and dried.

I have received four specimens of this species, two from my friend Captain Thomas, of the hydrographical survey, dredged at the Orkney Islands in 35 fathoms; one from the late Mrs. Griffiths, who obtained it from Exmouth; and one from the Rev. A. M. Norman, from Guernsey. This

sponge is remarkably variable in its form; one of the specimens from Orkney is in the shape of a short irregular cone, one inch and a half in height, with a large fistulous cavity extending from the centre of the base to the apex, with numerous small oscula on the sides of the cavity, which is about three lines in diameter. The second specimen is a compressed mass, rather less than an inch in height, one and a quarter inch in length, and half an inch in thickness, having four large oscula on the distal ridge nearly equidistant, and a fifth osculum terminating a short curved columnar branch, thrown off one side of the sponge midway between its base and apex, and partially impressed on its side. The third specimen from Exmouth is parasitical, running irregularly over a small portion of the surface of a specimen of *Halichondria panicea*, about one and a half inch in length. It follows the sinuosities of the surface of the sponge, to which it adheres without becoming elevated from it at any part, although about half an inch of its substance has a compressed columnar form, like that projected from the side of the second sponge described above. One small osculum only was apparent, and this specimen is evidently not fully developed.

In all the specimens the pores were barely visible to the unassisted eye. Many of them were, comparatively speaking, of larger size. They are not indiscriminately dispersed, but are collected in numerous groups of irregular size and form, and their areas are usually destitute of dermal spicula. These peculiarities of the dermal tissues form excellent distinctive characters for separating this species from *Isodictya densa*, in the dermal membrane of which species no such membranous areas exist. In other respects the two species resemble each other closely in their structural characters; the spicula of each are of the same length, but those of *I. densa* are much the stouter of the two. The dermal membrane is pellucid, and I could not detect any spicula imbedded in its surface excepting those of the skeleton immediately beneath it; but the interstitial membranes of the interior are scantily furnished with slender acerate tension spicula.

The fasciculi of the skeleton has seldom more than two or three spicula bound together, and these are short, not exceeding half the length of those of *Halichondria panicea*; but in proportion to their length they are rather stout. A full-sized one measured  $\frac{1}{15}$ th inch in length. The colour of the three specimens is uniform, a rich nut-brown throughout their whole substance.

From the variability in its form, and the general paucity of determinable characters, I have designated this species *indistincta*.

## 12. ISODICTYA DENSA, *Bowerbank.*

**Sponge.** Massive, sessile, or parasitical; surface uneven, but smooth. Oscula simple, or slightly elevated, dispersed. Pores inconspicuous. Dermal membrane pellucid, furnished with a unispiculate dermal network; spicula same as those of the skeleton. **Skeleton.** Rigid and strong; primary lines bi or trispiculose; spicula fusiformi-acerate, stout, and short.

**Colour.**—Light brown.

**Habitat.**—Polperro, Cornwall, Rev. A. M. Norman.

**Examined.**—In the dried state.

I am indebted to my kind and indefatigable friend, the Rev. A. M. Norman, for my knowledge of this species. He sent me four specimens for examination, all of which were collected at Polperro. None of them exceeded two inches in diameter, and a thickness of about four lines. The bases of three of the specimens exhibit evidence of only partial attachments to a flat surface, and the fourth was parasitical on a Sertularian Zoophyte, the branches of which pass out through several parts of its surface. The structural characters of the sponge are few and simple, but they are at the same time distinct and striking.

There is a close structural resemblance between this species and *Isodictya indistincta*, but the spicula of the

latter, although of the same length, as those of *I. densa*, are considerably less in their diameter, and in *I. densa* we do not observe the large irregularly shaped porous areas in the dermal membrane, which are so characteristic in *I. indistincta*.

The skeleton spicula of *I. simulo* are also of about the same length as those of *I. densa*, but they are still more slender than those of *I. indistincta*.

The sarcode has been very abundant, and in its present condition is of a dark amber colour.

### 13. ISODICTYA ANOMALA, Bowerbank.

Sponge. Massive, sessile; surface even. Oscula few, large, simple. Pores unknown. Dermal membrane, unknown. Skeleton. Primary lines multispiculous, very large and compact; secondary lines, usually a single spiculum; spicula inflato-fusiformi-acerate, short and stout. Interstitial membranes. Tension spicula, acerate, slender.

*Colour*.—Dried, yellowish-gray.

*Habitat*.—Torbay, Mrs. Griffiths.

*Examined*.—In the dried state.

The sponge which is the type of the above species is in truth but a fragment, apparently about the eighth part of a mass, having been about the size and form of a large walnut; or it may have received its curved and somewhat concave form by having partially surrounded the stem of a large *Fucus*; it is eight lines in diameter, and does not exceed three in thickness. For the depth of a line and a half from the surface the skeleton is composed of a series of stout parallel primary fasciculi of spicula, connected by secondary fasciculi, usually of single spicula, and polyspiculous, and the spicula composing them are remarkably stout in proportion to their length, and very variable in their fusiform structure; the amount of central inflation

also varies considerably, sometimes it is obsolete, but usually it is more or less apparent, and occasionally very strongly developed. The small portion of membranous structure remaining attached to the skeleton is rather stout, and but sparingly furnished with the slender acerate spicula. The general arrangement of the symmetrical portion of the skeleton is very like that of *Chalina seriata*, but the absence of horny fibre, and the peculiar form of the skeleton spicula in *Isodictya anomala*, readily serves to distinguish it from the former species, even though in their live state their form and colour should prove to be perfectly similar. I am indebted to my kind friend, the late Mrs. Griffiths, for this interesting species.

The deeper portions of the structures are very confused, assuming much the appearance of a coarse stout *Haliclona*, so that with our present very limited knowledge of the natural extent of the interior portion of the sponge, it becomes very difficult to say whether the regular interior or the regular exterior portion of the structure should have the greater influence in the determination of its generic disposal; under all the circumstances of the case, I have thought it advisable to refer it, in accordance with its exterior portion, to the genus *Isodictya*.

The surface of the sponge is even, and the whole of the dermal membrane appears to have been removed by long-continued maceration, but the present surface is thickly furnished with porous passages, and there is one large, slightly depressed oval osculum, near the middle of the outer surface, about the eighth of an inch in length.

The fasciculi of the skeleton are very stout.

#### 14. ISODICTYA SIMPLEX, *Bowerbank*.

Sponge. Sessile, massive. Surface even, or more or less tuberous, hispid. Oscula simple, disposed on the summits of the tuberous elevations, large. Pores conspicuous. Dermal membrane aspiculous. Skeleton. Compact and regular; primary lines multispor-

lous; secondary lines unispiculous; spicula acerate, rather short. Interstitial membranes, aspiculous.

*Colour*.—Alive, white, with a tint of brown; dried, dark brown.

*Habitat*.—Off St. Martin's Point, Guernsey, Rev. A. M. Norman.

*Examined*.—In the dried state.

I received five specimens of this sponge, of various sizes, from my friend the Rev. A. M. Norman, who obtained them while dredging in company with Mr. J. Gwyn Jeffreys, off Guernsey. He describes their colour, when alive, as "whity-brown." The largest of the specimens in the dried state is one and three-quarters of an inch long, nearly an inch in width, and about half an inch in thickness. The tuberous elevations on the surface are not always equally well developed. In one of the five specimens they were merely indicated by a slight elevation of two of the oscula; in another they were strongly produced in a group at one end of the sponge, and very slightly so at the other, and a third specimen, three-fourths of an inch in length, consisted of one large separate tuberous mass, eight lines in height, and three others rather smaller but confluent, each terminating in a large osculum. It is, therefore, apparent that the external form of this species is very variable. The oscula are very large for so small a sponge, varying from one to two lines in diameter. The pores are evenly dispersed over the whole surface, and may be readily seen in a dried specimen by the aid of a lens of an inch focus. The surface of the sponge is strongly hispid, by means of the projection of the distal terminations of the primary lines of the skeleton, which pass through the dermal membrane to the full extent of the length of a single spiculum. The dermal membrane is supported on the terminal areas of the skeleton, and it is entirely destitute of tension spicula. In the areas thus formed one very large or several smaller pores may usually be seen. The spicula of the skeleton are all as nearly as possible of the same size and form,

and the structural characters of the sponge exceedingly simple.

The only species with which, in the dried state, it might be confounded is *I. indistincta*, but the rete is very much more regular than in that species, nor are the pores congregated as in *I. indistincta*. The hispid condition of the dermal membrane also strongly marks the difference between them.

### 15. ISODICTYA JUGOSA, Bowerbank.

**Sponge.** Sessile, coating. Surface uneven, ridged, and furrowed minutely hispid. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, furnished rather abundantly with simple and contort bihamate spicula. Skeleton. Somewhat irregular; spicula acerate, rather long and stout. Interstitial membranes; furnished rather sparingly with simple and contort bihamate spicula.

**Colour.**—Dried, light fawn-yellow.

**Habitat.**—Shetland, Rev. A. M. Norman.

**Examined.**—In the dried state.

This little sponge is parasitical on a small group of vermetus. It is nine lines in length, and about two lines in thickness. When viewed with a lens of two inches focus, the surface is seen to be full of prominent ridges and deep furrows, running in tortuous directions. The hispitation is comparatively bold and strong. It is produced by the projection of the distal terminations of the primary radial lines of the skeleton. The oscula are comparatively large and numerous, especially at the distal end of the sponge. The bihamate spicula of the dermal membrane are abundant, but they are not visible without the aid of Canada balsam.

A dried specimen of this sponge may be readily mistaken for a specimen of *Isodictya indefinitus*, the structural

peculiarities of the skeleton, and the size and form of the spicula, closely resemble each other, but the presence of the bihamate spicula in *I. jugosa* readily distinguishes it when they are properly developed by Canada balsam.

### 16. ISODICTYA PALLIDA, *Bowerbank.*

**Sponge.** When young coating, massive and sessile; when fully developed, often running into a series of short, stout, inosculating branches or lobes; each having a central cloacal canal; surface smooth. Oscula simple or very slightly marginated, dispersed. Pores inconspicuous. Dermal membrane pellucid, smooth, furnished with a unispiculose network; spicula same as those of the skeleton, but rather more slender. **Skeleton.** Primary lines multispiculose; secondary lines often bispiculose, irregular; spicula fusiformi-acerate, short and stout. Interstitial membranes. Tension spicula fusiformi-acerate, slender, rather numerous.

**Colour.**—Alive, pallid gray or cream colour.

**Habitat.**—Torquay, Mrs. Griffiths. Diamond Ground off Hastings.

**Examined.**—In the living state.

I am indebted to the late Mrs. Griffiths, of Torquay, for my first acquaintance with this interesting species. The specimen is irregularly spread over a piece of rock about three inches in length, and does not exceed half an inch in thickness; occasionally small columnar or conical portions are thrown out laterally, which attain about half an inch in height by a quarter of an inch in thickness. The surface is smooth and undulating, and the oscula, which are perfectly simple, are dispersed equally over the whole surface and are about a quarter or half an inch asunder; they are nearly equal in diameter, which does not exceed two

thirds of a line. A few of the pores are visible through an inch lens, but the greater number are very minute.

The dermal membrane is transparent, and the unispiculous network is a very beautiful object; the areas are much more frequently triangular than quadrangular, and a considerable number of them have each a circular or oval pore; about one in every three or four are thus perforated. The interstitial membranes are but sparingly furnished with spicula.

There were two other small columnar-shaped specimens in the same collection, one of which may have originally formed part of the large specimen, but the other appears to have been a young one of the same species, although of a short columnar form. This specimen was remarkable from its having the spicula of the dermal network somewhat less in diameter than those of the skeleton. In the adult specimen this was not the case; in all other respects the two agreed exactly in their organization.

In the young specimen of this species and in parts of the mature one the symmetrically disposed primary lines of the skeleton were strikingly apparent for a considerable depth beneath the outer surface, while in other parts of the surface of the mature specimen they were few and not readily discernible, and had it not been for the more equable character of the network than what we are accustomed to see in *Halichondria*, the sponge might have been readily mistaken for a member of that genus, and especially so if the examination had been confined to the deep-seated portions of the mass.

A full-sized spiculum measured  $\frac{1}{76}$ th inch in length.

I subsequently received three specimens of this sponge from the trawlers off Hastings. One of them, about the form and size of a dried fig, the other two had assumed the inosculating branched or lobular form; the largest of the two was of an irregular triangular form, each side being about four inches long, and the greatest thickness was about ten lines. In the living state the sponge was soft and gelatinous to the touch, but not slimy; the sarcodae was very abundant, and it contained numerous minute

spherical cells, some containing a nucleus, while others were filled with minute granules. In the living specimens the tension spicula were much more abundant than in those from Torquay; in every other respect, the specimens, although so various in size and form, were in perfect accordance in every anatomical character.

### 17. *ISODICTYA FISTULOSA*, *Bowerbank*.

**Sponge.** Massive, sessile. Surface uneven, furnished abundantly with fistulæ of various sizes; fistulæ simple or branched, parietes thin. Oscula terminating large fistulæ, parietes thin. Pores conspicuous, very numerous. Dermal membrane thin and pellucid, furnished with a unispiculous network; hispid, spicula same as those of the skeleton; tension spicula acerate, slender, very few in number. Skeleton. Slender and delicate, rather irregular; primary lines frequently only unispiculous; secondary lines unispiculous; spicula acerate. Interstitial membranes. Tension spicula acerate, slender, very few in number.

**Colour.**—Alive, white with a tint of pink, Rev. A. M. Norman. Dried, cream white.

**Habitat.**—Off Saint's Bay, Guernsey, Rev. A. M. Norman.

**Examined.**—In the dried state.

I received two specimens of this sponge from the Rev. A. M. Norman. The largest was two and a half inches in length by one and a half in breadth, and an inch in thickness; the second one was one and a half inch long, one and a quarter wide, and three fourths of an inch in thickness. The surface of the largest specimen was crowded with large and small fistulæ, varying in height from one or two lines to seven or eight, and in diameter from one to four lines. The largest ones usually terminated in one large oscular orifice. The distal terminations of the smaller

ones were all closed, but very porous, and the pores large and distinctly visible by the aid of a two-inch lens. The fistulæ are perfectly hollow; their parietes are very thin, and their bases are immediately over the confluent terminations of two or more of the excurrent canals of the sponge, which renders it probable that while the pores of their parietes are incurrent organs; those of their distal terminations may be excurrent ones, as in the mammillæ of the genus *Polymastia*. The fistulæ are usually simple cylinders, terminating more or less hemispherically, but occasionally after passing from the sponge in this form for half their length they divide into two or more short branches. The pores are exceedingly abundant, and are so large as to be readily visible by the aid of a lens of two inches focus. The dermal membrane is a very beautiful object beneath the microscope. The sides of the areas of the network never exceed the length of a single speculum; the areas are various in form, but usually either three or four sided. The hispidation does not consist of prolongations of the primary lines of the skeletons, but it is produced by the projection of single spicula from the angles of the dermal reticulation; occasionally, but rarely, there are two in place of one. The structure of the skeleton is very fragile and irregular; a few of the primary lines only have more than a single series of spicula.

In the second specimen the fistulæ are few in number and are not so well developed as in the larger ones; but in their place we have three large oscula, the largest termination a fistular projection six lines in height and about the same in diameter.

This species is readily distinguished from *J. pallida* in the dried state by the hispidation of its dermal membrane and by the greater size of its spicula, which, although of the same form and diameter, are very considerably longer, their proportions in that respect being as four to three.

**18. ISODICTYA GREGORII, Bowerbank.**

**Sponge.** Sessile, coating, fistulous. Surface uneven, with ridges, prominently hispid. Oscula simple, small and dispersed; or large and terminal. Pores inconspicuous. Dermal membrane pellucid; sparingly spiculous; spicula same form and size as those of the skeleton. **Skeleton.** Primary lines rarely more than bispiculous; secondary lines unspiculous; rete width of the length of one spiculum; spicula acerate, rather long and slender. External defensive spicula, same as those of the skeleton. Tension spicula, same as those of the skeleton, few in number.

**Colour.**—Dried, cream yellow.

**Habitat.**—Moray Frith, the Rev. Walter Gregor.

**Examined.**—In the dried state.

I am indebted to the Rev. Walter Gregor, of Aberdeen, for my knowledge of this species. The sponge coats about a fourth of the interior surface of half of a bivalve shell about an inch and a quarter in diameter, straggling in irregular ridges over the surface it covers, and each of the ridges appears to be fistulous. Numerous small oscula are situated on the crown of each of the ridges, and the largest of them is terminated by a single large osculum of about the same diameter as that of the fistulous cavity of the ridge.

The hispitation of the surface is remarkably prominent in proportion to the size and structure of the sponge. It is produced by the projection beyond the dermal membrane of the distal terminations of the primary radial lines of the skeleton; and these defences frequently extend to the length of one and a half or two spicula beyond the dermal surface, terminating with one or two slightly diverging spicula.

The skeleton spicula are rather slender in their proportions; one of the largest and best developed specimens measured  $\frac{1}{16}$ th inch in length.

The length of the spicula of this sponge is very nearly the same as that of *I. pallida*, *cinerea* and *indistincta*, but it may be readily distinguished from these species by its external characters, and especially so by its prominent hispidation.

I have dedicated this species to the Rev. Walter Gregor, late of Macduff, now of Aberdeen, an able and ardent working naturalist, to whom I am indebted for the use of many interesting northern species during the progress of my work.

#### 19. ISODICTYA FALLAX, *Bowerbank.*

Sponge. Massive, sessile. Surface even, smooth; furnished irregularly with fistular projections, variable in size and form; parietes thin. Oscula terminating large fistulae. Pores conspicuous, numerous. Dermal membrane thin and pellucid, furnished with a unispicular network, smooth; spicula same as those of the skeleton; tension spicula acerate, very slender, few in number; and tricurvate acerate, minute and very slender, rather numerous. Skeleton. Diffuse and very irregular; primary and secondary lines scarcely to be distinguished, mostly unispiculous; spicula acerate, rather long. Interstitial membranes. Tension spicula same as those of the dermal membranes.

*Colour*.—Dried, light gray.

*Habitat*.—Off Saints' Bay, Guernsey, Rev. A. M. Norman.

*Examined*.—In the dried state.

I received the specimen described above, in company

with two others, which proved, on examination, to be *Isodictya fistulosa*; but the two species so exactly resembled each other in their external characters, as to render it quite impossible, in the dried state, to have distinguished the one from the other. When anatomically examined this difficulty at once disappeared. The greater length of the spicula as compared with those of *I. fistulosa*, being in the proportion of three or three and a half in the former to two in the latter, at once serves to mark the difference existing between them and the presence of the tricurvate spicula in the membranes, and the absence of dermal armature confirms this conclusion. The fistular projections on the surface of the sponge are very like those of *I. fistulosa*, as alluded to in the description of the smaller specimen of that species which I have described, and it agrees closely with it also in size, being an inch and three quarters in length, and an inch in average diameter. The careful observation of these differential characters is very necessary when the external character of two species so closely resemble each other.

The very diffuse and irregular structure of the skeleton causes it to closely simulate the generic characters of a Halichondria, and it is only near the surface that its structure can be satisfactorily determined, and the comparatively large size of its spicula strongly favours the illusion generated by the irregularity of its skeleton. The tricurvate acerate spicula are very slender and delicate, and require a microscopic power of two or three hundred linear to exhibit them distinctly. In all of them the middle curve is well developed, but the terminal curves in many of them are very slightly produced. In some of the areas of the dermal network they are comparatively numerous, while the acerate slender tension spicula are of rare occurrence. The pores are visible by the aid of a lens of two inches focus.

**20. ISODICTYA ROBUSTA, Bowerbank.**

Sponge. Cup or fan-shaped, pedicel? short. Surface; outer or inhalent one smooth; inner or exhalent one, furnished with numerous large oscula. Oscula dispersed, simple, or slightly elevated. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous; spicula dispersed, acerate, same as those of the skeleton. Skeleton. Primary lines frequently large and numerously spiculous; secondary lines very irregular, often multispiculous; spicula acerate, very rarely acuate, large and strong. Interstitial membranes. Retentive spicula simple bihamate, nearly semi-circular, minute, and very few in number.

*Colour.*—Dried, light ochreous yellow.

*Habitat.*—Shetland, seventy to ninety fathoms, Rev. A. M. Norman.

*Examined.*—In the dried state.

I received this species from the Rev. A. M. Norman, who dredged it at Shetland in 1861. The sponge is irregularly cup-shaped, about an inch and a half in height, and three and a quarter inches wide at its greatest expansion. Its thickness varies from two to about five lines. It has every appearance of having at an early period of its growth been attached to some base by probably a short pedicel, but there are no remains visible of such an attachment at the present time. The oscula are numerous and large, frequently attaining a diameter of two lines, and an elevation of about a line. The skeleton has singular structural peculiarities. What we should designate the primary and secondary lines of the skeleton, considering it as an Isodictya, are in perfect accordance with the usual forms assumed in the corresponding parts in the best developed specimens of that genus; but in addition to these structures, there are large multispiculous fasciculi,

closely resembling the multispiculous keratose fibres of a *Desmacidion*, running irregularly amidst the other portions of the skeleton, in directions more or less parallel to the outer surfaces of the sponge, but without appearing to interfere with, or subordinate to its stronger parts, the original isodictyal portions of the skeleton. These peculiarities of structure strongly induce me to believe that the sponge should form the type of a new genus; but for the present, and until we obtain further knowledge of it, it will be as well to allow it to be considered as an *Isodictya*.

The retentive spicula are very minute, and apparently very few in number. In their form they very nearly approach that of a semicircle.

The Rev. A. M. Norman found this species very abundant about thirty miles east of the Outer Skerries, Shetland.

## 21. *ISODICTYA POCILLUM*, *Bowerbank*.

Sponge. Cup-shaped, pedicelled. Surface irregular, rugose, hispid. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane aspiculous. Skeleton. Irregular and indistinct in its structure; primary lines multispiculous; secondary lines also frequently multispiculous, or confusedly unispiculous; spicula acerate, stout. External defensive spicula attenuato-acuate, slender, and very long.

*Colour*.—Nut-brown, in the dried state.

*Habitat*.—Off Saints' Bay, Guernsey, Rev. A. M. Norman.

*Examined*.—In the dried state.

I have seen but one specimen of this sponge. It is irregularly cup-shaped, and does not exceed an inch in height. It is elevated on a short stout pedestal, about a quarter of an inch in length, and its greatest diameter is three quarters of an inch; its thickness does not

exceed about a line. The most remarkable character in its structure is its hispidation, which is in part produced by the projection of the terminations of the primary fasciculi of the skeleton, which radiate slightly at their distal extremities ; but beside these defensive appliances, there are numerous long, slender, attenuato-acuate defensive spicula, which have their bases immersed in the body of the sponge, frequently to about half the length of the spiculum ; in other cases, they have their origin at very slight distances beneath the dermal membrane. They are not always based on the primary lines of the skeleton ; but frequently spring from the membranes, without contact with any portion of the skeleton tissues. These spicula are very little more than half the diameter of those of the skeleton, and are three or four times their length.

In the specimen under consideration, the large defensive spicula appear to be very much more numerous on the inner surface of the cup than on the outer one, and they are very distinctly apparent by the aid of a lens of an inch focus, but this difference between the two surfaces may probably arise from the greater amount of exposure to injury of those of the outer one, from the attrition of the bodies surrounding the sponge in its natural condition. The irregularity in the structure of the skeleton tissues is very great ; the primary lines are frequently very loosely fasciculated, and the secondary ones, when not multi-spiculous, are so irregularly disposed, as to frequently render it difficult to say whether they are properly skeleton spicula or tension spicula, of the same size and form ; but as there are no tension spicula on the dermal membrane, it is most probable that they are disrupt-spicula of the secondary portions of the skeleton tissue.

## 22. ISODICTYA MAMMEATA, *Bowerbank.*

**Sponge.** Massive, sessile, parasitical on Fuci. Surface smooth, mammillated. Oscula terminal on the mammæ, simple. Pores inconspicuous. Dermal mem-

brane pellucid, aspiculous. Skeleton. Primary and secondary lines unispiculous. Spicula acerate, short and stout. Interstitial membranes. Tension spicula acerate, slender, few in number.

*Colour*.—Cream white.

*Habitat*.—Guernsey, Rev. A. M. Norman; Diamond Grounds, off Hastings, J. S. Bowerbank.

*Examined*.—In the fresh state.

This sponge was obtained by the Rev. A. M. Norman at Guernsey, in 1859. It is two inches long, rather less than one-inch broad, and about five lines in thickness. It envelops the branches of a slender species of *Fucus*, on which it is evident it was based when alive.

The habit and general external characters of this sponge so closely simulate those of *Isodictya lobata*, *Spongia lobata*, Montagu, that without a microscopical examination it would be very difficult, if not impossible, to distinguish the one from the other; but the difference in the form of the spicula will immediately separate them. The mammæ are not uniformly produced; some of them did not exceed a line in height, while others were three or four lines, but they had all a single terminal osculum. The skeleton is of very delicate structure; the primary lines being rarely more than unispiculate, and the areas of the network being rarely wider than the length of a single spiculum. The lines of the skeleton are thickly coated with sarcode, so much so as to cause a thin slice of it, when examined in water, to be readily mistaken for a delicate form of *Chalina*; but on immersion in Canada balsam, the sarcode contracts into a granulated state, and the skeleton assumes the normal form of a true *Isodictya*.

Nearly the whole of the dermal membrane was destroyed. In the few fragments remaining I could not detect a single tension spiculum, and very few of them were visible on the interstitial membranes. An adult spiculum of the skeleton measured  $\frac{1}{12}$ th inch in length. I subsequently obtained a larger specimen of this species, from the Diamond Ground,

off Hastings, in the spring of 1863, parasitical on a *Sertularia*. It agrees very closely with the type specimen in all its essential characters.

### 23. ISODICTYA SIMULANS, *Bowerbank*.

*HALICHONDRIA SIMULANS*, *Johnston*.

**Sponge.** Sessile, simply branching, or irregularly latticed by cylindrical inosculating branches, or polymorphous. Surface smooth. Oscula simple or slightly elevated, frequently at nearly regular intervals on one side of the branch. Dermis furnished with a strong irregular reticulation of single spicula; spicula acerate, same size as those of the skeleton; dermal membrane pellucid, aspiculous. Skeleton. Compact and stout, rather irregular; primary lines multispiculous; secondary lines rarely more than unispiculous, numerous, and irregularly disposed; spicula acerate, short and stout. Interstitial spaces large and irregular; membranes nearly obsolete, aspiculous.

**Colour.**—Dull green or dusky brown.

**Habitat.**—“Connemara, Wm. M. Colla; Dublin Bay, Dr. A. H. Hassall.” Brighton, Mr. Thos. Ingall; Tenby and Diamond Ground, off Hastings, J. S. Bowerbank.

**Examined.**—In the dried state.

In its full state of development this sponge has as complex a latticed form of its branches as the best developed specimens of *Chalina Montagu*, but it is more frequently found in the form described and figured in Dr. Johnston's 'History of British Sponges,' plate viii, figs. 1 and 2, p. 109.

In the fresh state this species is strong and rigid, and when dried, hard and brittle. In its simplest branching form, the oscula are frequently disposed on one side of the branch, and at nearly equal distances from each other, and

they are usually elevated to the extent of one or two lines above the general surface. The dermal network is close and strong, and the areas more frequently assume the triangular form than any other. The skeleton is very irregular, in consequence of the great size and inequality of the intermarginal and interstitial cavities; but the structural characters of an *Isodictya* are unmistakeably present. The normal form of the spicula is acerate, occasionally somewhat fusiform, and very rarely an acuate or a subcylindrical form may be observed. No traces of tension spicula could be detected; and excepting in the intermarginal cavities the interstitial membranes were rarely present, but the whole of the skeleton structure was abundantly covered by sarcodes.

In the collection of Montagu's Sponges, in the possession of Professor Grant, a fine specimen of this species is labelled *Spongia coalita*, and Montagu has described it in the Wernerian Memoirs, vol. ii, p. 80, as "rather compressed, and of a brittle, coky nature." This description applies much better to *H. simulans* than to *H. coalita*, for which species Montagu has apparently mistaken his specimen.

#### 24. *ISODICTYA DICHOTOMA*, Bowerbank.

**Sponge.** Arborescent, pedicelled, surface smooth. Oscula simple, dispersed, few in number. Pores visible. Dermal membrane thin, pellucid, furnished with a unispiculous network of short acerate spicula. **Skeleton.** Primary lines bi or trispiculous; secondary lines unispiculous; rete the width of the length of one spiculum; very regular and distinct. Spicula acerate, short and stout. Interstitial membranes. Tension spicula acerate, short and slender.

**Colour.**—Light ochreous yellow, alive and dried.

**Habitat.**—Hastings, a mile off shore.

**Examined.**—In the dried state.

The form of this sponge is an irregular series of confused short, stout, and somewhat compressed ~~in~~osculating branches, elevated on a short pedicel. The entire height slightly exceeds three inches, and the extreme lateral extension is very nearly equal to the height. The true base of the sponge is not preserved, and the present base has been rounded off by the action of the sea. The oscula are few in number, and are more frequently situated on the edges than on the expanded portions of the branches ; the largest does not exceed a line and a half in diameter. The largest of the pores are barely visible to the unassisted eye, but by the aid of a lens of two inches focus, they are very apparent. The unispiculous network of the dermal membrane is a very beautiful object ; the spicula of which it is composed are of the same form and of very nearly the same proportions as those of the skeleton, the only difference being, that the greater portion of them are scarcely as stout. The interstitial membranes are very pellucid, and, in the specimen under consideration, are not very abundantly furnished with sarcode ; but as the sponge has been much worn by the action of the sea previously to being taken, it is probable that much of the sarcode may have been washed out of it. The spicula of the interstitial membranes are few in number, and of the same form as those of the skeleton, but shorter and much more slender in their proportions.

The sponge was brought up by the trawl about a mile off Hastings, nearly opposite to the Castle Hill.

A full-sized skeleton spiculum measured  $\frac{1}{60}$ th inch in length. A second specimen, for which I am indebted to Dr. G. B. Turner, of Hastings, who found it on the beach opposite St. Leonard's, has the branches more decidedly compressed than the first one, and the oscula are from one tenth to one eighth of an inch in diameter. The sponge is of the same height as the first one, but much less complex in its mode of branching, and the mode of the exterior of the sponge in this specimen appears to be by regular bifurcations.

**25. ISODICTYA PALMATA, Bowerbank.**

- *HAIYCHONDRIA PALMATA*, Johnston.

**Sponge.** Sessile or slightly pedicelled, arborescent or palmate and digitate, compressed. Surface even. Oscula simple, or margins slightly elevated. Pores inconspicuous. Dermal membrane pellucid, spiculous; tension spicula same as those of the skeleton, irregularly dispersed, few in number; and equi-anchorate retentive spicula with bifurcate terminations, with exserted points; irregularly dispersed, very numerous. **Skeleton.** Open and diffuse; primary and secondary lines multispiculous, rete more than the length of one spiculum in width; spicula acerate, stout, and rather short. Interstitial membranes. Tension spicula same as those of the skeleton; retentive spicula same as in the dermal membrane, irregularly dispersed, exceedingly numerous.

**Colour.**—Dark red brown in the dried state, or light gray.

**Habitat.**—Coasts of Northumberland and Scotland, Mr. Alder and Mr. Peach. Orkney Islands, Mr. McAndrew.

**Examined.**—In the dried state.

This sponge is, I believe, the Mermaid's glove of the Orkney fishermen. I received a fine specimen from Mr. McAndrew in 1851. It is thirteen inches in height, and about nine inches at its greatest width; it is palmate, and has a rude resemblance to a glove. This is the only case in which I have seen it assume this form. It usually consists of a number of stout, irregular, and somewhat compressed branches, and is frequently a foot in height. There are two fine specimens of this description in the Newcastle Museum; the finest of the two was found by Mr. Alder, at Holy Island, and the second one by Mr. W. J. Foster,

was obtained from the Northumberland coast. I have also since received fine specimens from my friends, Mr. Joshua Alder and Mr. Peach; that from the latter gentleman and the one from Mr. McAndrew have the whole of their tissues in a remarkably fine state of preservation. The colour of the glove-shaped specimen from Orkney in its dried state is a rather deep red brown, while those of the Newcastle Museums, from the thorough washing they have undergone, are of a light gray.

From the mode of the growth of this sponge it is probable that it is perennial. It is not developed at once, but by a series of efforts which may be readily made manifest by holding the sponge up to the light, when the commencement and termination of each stage of growth is strikingly apparent. I have seen as many as six of these stages of growth in a branch about eight inches in length. In the old and fully mature portions of the sponge, the central parts of the lines of the skeleton-structure do not occupy more than one third of the diameter of the primary line of the skeleton, the remaining external portion being solid keratode; but the newly-formed parts of the rete of the distal extremity of the last of the periodical additions to the sponge have much the appearance of that of a *Desmacidon*, consisting of a compact and continuous fasciculus of spicula, with little or no indication of an external sheath of keratode.

In the older portions of the sponge, the interstices of the skeleton do not appear to be filled with sarcode, but the rete is covered with it, and a few of the anchorate spicula may be seen imbedded in it; but, in the young and growing portions of the sponge, the interstices are furnished with membranes thickly coated with sarcode, which is literally crowded with the equi-anchorate spicula. These organs are very remarkable in their form; the middle portion of the shaft is curved outward in the usual manner, and the two extremities are bent into hooks like a simple bihamate spiculum, but instead of the distal portion of the hooks continuing in accordance with the primary lines of projection from the middle of the shaft near each end of

the spiculum, there is a slight flexure downward and again upward, so that the apices in the adult spiculum regain the position they would have occupied had their flexures never occurred. But this flexuous bihamate form has a further development; fimbriations appear on the sides of the shaft, especially towards the hamate extremities, and which are produced to such an extent that they ultimately form two deep terminal pouches, with the mouths of each facing the other, the shaft and the apices of each hook being the two points of support, and the lateral portions of the mouth are distended so as to become nearly or quite circular. Occasionally, the siliceous membranes are decurrent, meeting at the middle of the shaft. These fully-developed forms were by no means common in the sponge examined, and by far the greater number of the spicula were in a more or less incomplete state of development. The siliceous film of which the pouches are formed is extremely thin and transparent, and requires a careful management of the light to define it well with a power of 600 or 700 linear. The spicula are very minute.

## 26. ISODICTYA PYGMEA, *Bowerbank.*

*HALICHONDRIA PALMATA*, *Johnston.*

**Sponge.** Arbuscular, pedicelled; palmate, or branching laterally, more or less compressed. Surface even. Oscula simple, dispersed, terminal or lateral. Pores inconspicuous. Dermal membrane thin, pellucid, aspiculous. Skeleton. Slender; primary lines rarely more than bispiculous; rete, one spiculum wide; spicula acerate, short, and rather stout. Interstitial membranes. Spicula acerate, slender, few in number.

**Colour.**—Dried, dull light brown.

**Habitat.**—Scarborough, Mr. Bean.

**Examined.**—In the dried state.

This small and often palmate species is figured in plate ii, figs. 2 and 3, in Dr. Johnston's 'History of the British Sponges,' as a small variety of *Halichondria palmata*, but it differs materially in its structure from that species. In its general form and habit it has much the appearance of very small specimens of *Chalina oculata* when both species are in a dried state; and the delusion may still exist if examined in water only, as the lines of the skeleton are frequently so thickly coated with sarcode as to simulate the cylindrical keratose fibres of a Chalina, and the mistake is further favoured by the spicula within being completely hidden by the surrounding sarcode; in other specimens, where the casing of sarcode is not so thick, their true character is more apparent, but a preparation of a section at right angles to the axis of the sponge immediately dissipates the illusion, and all the false appearances of keratose fibre disappear. I have seen a considerable number of specimens of this species. They rarely exceed two and a half inches in height. The pedicel is slender and about half an inch in height, and it rises from a thin spreading base. The branching appears to be always laterally, and oscula rarely occur excepting on the edges or terminations of the branches. The dermal membrane in the specimens in my possession has been nearly all destroyed by maceration in fresh water. I examined the small remainder of it, but could not detect any spicula in it. In the interstitial membranes, they appear to have been very few in number. I am indebted to my friend Mr. Bean of Scarborough, for my knowledge of this species, and for several very characteristic specimens of it.

## 27. ISODICTYA RAMUSCULUS, *Bowerbank.*

Sponge. Branching. Surface smooth and even. Oscula prominently elevated, very large, few in number. Pores inconspicuous. Dermal membrane aspiculous. Skeleton. Unispiculose; spicula subfusiformi acerate,

rather short and stout. Interstitial membranes, tension spicula acerate, slender, few in number.

*Colour*.—Light lake, or rosy lilac.

*Habitat*.—Roundham Head, Torbay, Mr. Gosse.

*Examined*.—In the dried state.

I am indebted to my friend Mr. Gosse for the only specimen of this species that I have seen. He found it on the under surface of a soft red sandstone at Roundham Head, Torbay, and he states that it "is of a delicate light lake, or rosy lilac, when alive."

The sponge is about a line short of two inches in height, and is formed of one tortuous upright branch, smallest near the base, and largest near the middle, where it is three lines in diameter. In its present dried state it is compressed laterally to a considerable extent; but it is probable that this is due to its having been dried between papers. It has five large prominently elevated oscula, one near the base, two near the middle, and two terminal ones; each osculum being about a line in diameter.

The spicula of this species are as stout and somewhat longer than those of *D. varians*, but there are no acuate ones mixed with them, as in that species. They differ from those of *D. permollis* in being nearly twice their diameter, although about the same in length; and from those of *D. cinerea* in being very much less in length, although of about the same diameter. In *D. Peachii* the difference in size and proportion is so striking as to render a comparison unnecessary.

The skeleton spicula rarely exceeds  $\frac{1}{12}$ th inch in length.

The habit of this sponge appears to be distinctly different from that of any other known British species, the sub-ramose form, and the large elevated oscula presenting striking distinctive characters, that is presuming them to be constant.

**28. ISODICTYA CLAVA, Bowerbank.**

Sponge. Massive, club-shaped, slightly pedicelled. Surface hispid. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane sparingly spiculous; spicula acerate, slender; as long as those of the skeleton. Skeleton. Diffusive; primary lines rarely more than bispiculous; secondary lines unispiculous, frequently two or three spicula wide; spicula short and rather stout. External defences, continuations of the primary fasciculi. Interstitial membranes. Tension spicula, acerate, slender, few in number.

*Colour*.—Dried, light yellow, or fawn colour.

*Habitat*.—Moray Frith, the Rev. Walter Gregor.

*Examined*.—In the dried state.

I am indebted to the Rev. Walter Gregor, of Macduff, for my knowledge of this species. He obtained it from the Moray Frith. There were two specimens, neither quite five lines in height, on a rolled pebble, about two inches in length, and nearly covered by *Vernietus*. Both the specimens were club-shaped, with slightly expanded bases. In the structure the skeleton somewhat resembles that of *I. pallida*, but the rete is more diffuse, the surface hispid, while that of *I. pallida* is smooth, and the spicula of the two species very different in length; those of *I. pallida* being  $\frac{1}{16}$ th inch, while those of *I. clava* are  $\frac{1}{32}$ st inch in length. The spicula of the skeletons of *I. indistincta* and *clava* also resemble each other rather closely. They agree in form and diameter, but the latter are less in length than the former. The structural characters of these two species resemble each other so closely, that if it were not for the well-defined difference in the external forms of the sponge, they might readily be mistaken for each other.

I could not, in the absence of the dermal membrane in the specimens first described, detect the oscula, but in

others subsequently examined, they appeared to be rather numerous, and were regularly dispersed over the surface.

The tension spicula of the dermal membrane were very sparingly dispersed over its surface, but in the interstitial membranes they were in some parts rather abundant; they were of the same size and form as those of the skeleton, with an intermixture of others of more slender proportions.

The hispidation of the surface is caused by the projection beyond the dermal membrane of the distal terminations of the primary radial lines of the skeleton.

## 29. ISODICTYA INFUNDIBULIFORMIS, *Bowerbank.*

*HALICHONDRIA INFUNDIBULIFORMIS, Johnston.*

Sponge. Funnel-shaped, rarely fan-shaped; elevated on a short pedicel; distal margin blunt and rounded. Surface even; minutely hispid. Oscula simple, dispersed over all parts of the surface; small and very numerous. Pores inconspicuous. Dermal and interstitial membranes aspiculous. Skeleton. Spicula of the primary lines attenuato-acuate, stout and rather short; of the secondary lines acerate, stout, and rather short. External defensive spicula, same as those of the primary lines of the skeleton.

*Colour.*—Dried, ochreous yellow, with a tint of brown.

*Habitat.*—North-east and south-east Haaf Banks, Shetland, from 60 to 90 fathoms, Mr. Barlee; Hebrides, Mr. McNab; St. Martin's, Guernsey, 1861; Mrs. Collings.

*Examined.*—In the dried state.

I first received specimens of this sponge from my kind friend, the late Mr. Barlee, who dredged them up at the Haaf Banks, and I subsequently received from the Shetland Deep-sea fishermen, through the agency of Mr. Humphreys, fifty or sixty specimens, of various dimensions and shapes. Some of the younger ones were of the size and proportions of the specimen figured by Dr. John-

ston in his 'History of British Sponges,' while others assumed a widely expanded form of cup, very shallow in depth, and having a diameter of as much as eight or ten inches, and a few of the number were fan-shaped. I also received from fifteen to twenty specimens from the Hebrides and Loch Fine, dredged by Mr. Archibald McNab, a fisherman of Inverary. These specimens were remarkably small, few of them exceeding an inch and a half in height. I have also had the pleasure of seeing, through the kindness of the late lamented Dr. Fleming, the specimen described by him in his 'History of British Animals,' and it is undoubtedly the same species as those I have received from Shetland.

The whole of the specimens mentioned above are from northern localities, but in 1861 Mrs. Collings, the lady of the Seigneur of Sark, found a small specimen at St. Martin's, Guernsey. It was of the same size as those obtained from Loch Fine, not exceeding an inch in height, having the usual form of a small cup. The hispid character of this sponge is not readily detected in the fresh condition. It is produced by the projection of the terminal spicula of the primary lines of the skeleton. The characteristic structure of the skeleton in the genus *Isodictya*, is strikingly exemplified in this sponge, even to the extent of the primary and secondary lines of structure having separate and distinctly different forms of spicula. Those of the primary lines being almost always attenuato-acuate, and having their apices directed towards the distal portions of the sponge; while those of the secondary lines are as uniformly acerate. Occasionally a single spiculum of either form will be found out of place; but these cases are the exception, while the separation of the two forms is the rule.

### 30. *ISODICTYA DISSIMILIS*, *Bowerbank*.

Sponge. Pedicelled, branching and anastomosing in nearly the same plane. Surface even, hispid. Oscula simple,

dispersed. Pores inconspicuous. Dermal membrane aspiculous. Skeleton. Diffuse and irregular; primary lines loosely fasciculated, rarely more than trispiculous, spicula acuate, long; secondary lines irregular, sometimes more than unispiculous; spicula acerate, short. Interstitial membranes aspiculous.

*Colour*.—Alive, orange; dried, nut-brown.

*Locality*.—Off St. Martin's Point, Guernsey, Rev. A. M. Norman; Vazon Bay, Guernsey, Mr. Cooper.

*Examined*.—In the dried state.

The specimen is four and a half inches high, and six inches in width; the pedicel rather exceeds an inch in height, and is four lines in diameter, near the base; the branches are somewhat compressed, varying from four to six lines in their greatest diameter, and they bifurcate at short intervals in an irregular manner; the whole of them are nearly in the same plane, so that the form is ~~rudely~~ fan-shaped, and where they meet near the middle of the sponge they have anastomosed, forming a continuous surface more than an inch in breadth and height. In the dried state the surface is distinctly hispid, in consequence of the prolongation of the primary lines of the skeleton, three or four of the terminal spicula diverging at their distal terminations at the surface of the sponge. The skeleton is very irregular in its structure, especially in the deeply-seated parts, which are open and cavernous to a considerable extent, but near the external surface the structure is much more regular. The acuate spicula of the primary lines are about twice the length of the acerate ones of the secondary lines; and this difference in their form and size, combined with the striking external characteristics of the sponge, render the determination of the species comparatively easy and certain.

This species and *I. infundibuliformis* are the only two of the genus with which I am acquainted in which the primary lines of the spicula of the skeleton and those of the secondary ones are of two distinctly different forms.

Since the above description was written, I have received a second specimen from Mr. Norman, who obtained it from Mr. Cooper, of Guernsey, who found it at Vazon Bay. It is smaller than the type specimen, but in external characters it closely resembles it, excepting that the development of the branches is in a curved plane instead of being in a nearly flat one, and in consequence of having been too much washed it has lost its brown colour, and is now a light gray.

### 31. ISODICTYA NORMANI, *Bowerbank.*

Sponge. Sessile, massive, or sub-fistulous. Surface minutely hispid. Oscula large and numerous, slightly elevated, or sub-fistular. Pores inconspicuous. Dermal membrane pellucid, spiculous; spicula sub-fusiformi-acuate, long and slender, rarely acerate. Skeleton. Primary lines rarely more than trispiculose; secondary lines unispiculose, occasionally bispiculose; spicula fusiformi-acuate, stout. External defensive spicula same as those of the skeleton. Tension spicula sub-fusiformi acuate, long and slender. Retentive spicula bicalcarate, simple, bihamate, and rarely palmato-equianchorate.

*Colour.*—Dried, fawn yellow.

*Habitat.*—Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

My friend the Rev. A. M. Norman, sent me two specimens of this sponge. The smallest did not exceed an inch and a half in diameter, and was coating on both its broad surfaces, a small irregular mass of *Nullipora polymorpha*. This specimen was of a light ochreous yellow, with a tinge of rose colour. It had several slightly elevated oscula, the largest of which did not exceed the eighth of an inch in diameter. The second specimen is two inches and three quarters in length, two inches in width, and one and a half

in height, and is apparently two specimens, which have united by approximation, as they adhere only by a thin perpendicular plate of tissue. The larger portion is massive, and has several large terminal oscula on its crest. The smaller portion consists of two large fistulæ cemented together, the mouth of the largest being nearly five lines in diameter. The surface has a somewhat coarse and open texture, in consequence of the abundance and, comparatively speaking, large size of the intermarginal cavities; but the pores in the dermal membrane above these cavities are not visible without the aid of a microscopical power of about 100 linear.

The tension spicula of the dermal and interstitial membranes are about as long as those of the skeleton, but they are not more than half or one third of their diameter. The external defensive spicula are continuations of the primary lines of the skeleton, the spicula of which, when projected beyond the dermal membrane, diverge slightly from each other, forming groups of external defensive spicula.

The retentive spicula of this species are of a very singular form. They have the curve of the shaft of the spiculum abruptly reversed at its middle, for about one third of its length, so that the central portion of the bow becomes slightly incurvate instead of excurvate; and at each of the two points where this change of the line of its direction is effected, there is a slight spur projected. These spicula are very minute, and they require a power of about 1000 linear to define their structure in a satisfactory manner.

Mr. Norman's specimens were dredged off St. Martin's Point, Guernsey, on rocks, in about 30 fathoms water.

**32. ISODICTYA FUCORUM, Bowerbank.**

**HALICHONDRIA FUCORUM, Johnston.**

— **PARASITICA, Montagu.**

— **Brit. Mus. Collection.**

**Sponge.** Sessile, amorphous; surface even. Oscula small, simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, sparingly spiculous. Tension spicula acuate, same as those of the skeleton; retentive spicula simple bihamate, minute, dispersed, few in number. Skeleton. In the young state symmetrical; in the older specimens very diffusive and irregular; primary and secondary lines both more or less multispiculous. Spicula sub-fusiformi-acuate. Interstitial membranes. Tension spicula acuate, slender, few in number.

**Colour.**—Alive, bright red or pink, to pale ash or brown.

**Habitat.**—Common on most parts of the British coasts: Brighton, Mr. Thos. Ingall; Burrafirth Caves, Shetland, Rev. A. M. Norman; Scarborough, Mr. Bean; Hastings, J. S. Bowerbank.

**Examined.**—Alive.

My friend Mr. Ingall has found this species on the Brighton coast in considerable quantities, and of a bright pink colour; the specimens agree in structure with the one labelled "parasitic" in Montagu's collection of sponges, but the label is written with pencil, and appears to be a different handwriting from the rest of the labels. Montagu, in the Wernerian Memoirs, vol. ii, p. 114, says "the texture is rather coarse, and the fibres fimbriated," whereas in the specimen in his collection, and in all others that I have examined of the same species, the texture is decidedly fine and delicate, and there is no appearance of fimbriated fibre. I am therefore inclined to believe that the specimen

in Montagu's series of sponges is not the type of his *S. parasitica*. It is probable that Montagu may have given the description quoted above, from a specimen of the sponge which I have described under the name of *Desmacidon ægagropila*, as that species is not only coarse in texture, but also the fibre is frequently fimbriated.

I have received this species from Burrafirth Caves, Shetland, from the Rev. A. M. Norman, who says, when alive it is of the richest scarlet colour. Mr. Bean's specimens were parasitic on the branches of a *Sertularia*; they were very young, and the skeletons only were preserved. In the young state, the symmetrical arrangement of the network is generally distinctly demonstrated; the primary lines radiating from its base, and having secondary lines at nearly right angles to them. But in the older specimens this arrangement is not maintained, the whole becoming exceedingly diffused and irregular, and the primary and secondary lines of the skeleton, both being frequently multispiculous, increases the confusion. In the skeleton there are occasionally a few acerate spicula mixed with the acuate ones.

### 33. *ISODYCTIA ALDERI*, *Bowerbank*.

Sponge. Encrusting. Surface uneven, hispid. Oscula simple, dispersed. Pores inconspicuous, minute. Dermal membrane pellucid, furnished with dispersed minute bicuspid anchorate spicula. Skeleton. Primary lines multispiculous, stout; secondary lines variable, frequently multispiculous; spicula acuate, short, and stout. Interstitial membranes spicula acuate, slender, rarely acerate, slender; and bicuspid anchorate, minute, dispersed. Sarcodæ light red, abundant.

*Colour*.—Alive, faint red.

*Habitat*.—Bamborough, Northumberland, Mr. Alder.

*Examined*.—In the dry state.

Two specimens of this sponge were found by Mr. Alder on the shore at Bamborough. They were each of them spread irregularly over a surface of about two square inches, on no part exceeding two lines in thickness, and were based on a portion of the root of a large *Fucus*, covering and obscuring several species of *Lepralia*. Mr. Alder described the sponge in his note as "of a faint reddish colour when fresh;" he also described it as containing much gelatinous substance, and continued, "the surface is hispid, and under the microscope the fibres can scarcely be seen for granular matter imbedded in the substance."

The primary lines of spicula are distinctly and strongly developed in the skeleton of this species, and the secondary ones equally distinct and very regular, producing a well-marked scalariform appearance in the skeleton. The surface characters of the sponge appear frequently to be more or less modified by the *Lepralia* living beneath it, and it then assumes an open porous character; but when uninfluenced by such causes it is much closer in its texture, and is profusely and regularly hispid by the projection of the distal terminations of the primary lines of the skeleton. The oscula are few in number, irregularly dispersed, and are large for so thin a sponge; in some cases being a line in diameter, and occasionally being slightly elevated above the general surface. The dermal membrane at the base of the projecting spicula is pellucid, and is perforated by numerous minute pores; the bicuspid anchorate spicula with which it is furnished are irregularly dispersed and are rather numerous. The interstitial membranes are thin and transparent, and are occasionally coated with minute granules; they are furnished rather sparingly with slender acuate, and very rarely, acerate spicula, and it is also rather abundantly supplied with minute bicuspid-anchorate spicula which require a power of about 250 linear to render them readily visible. In a portion of the specimen kindly presented to me by my friend, Mr. Alder, the sarcode, when examined in water, was very abundant, filling the whole of the interstitial cavities in the form of a very minutely

granulated gelatinous substance semi-transparent and retaining its red colour.

### 34. ISODICTYA EDWARDII, *Bowerbank.*

Sponge. Sessile, parasitical, coating. Surface uneven, hispid. Oscula inconspicuous, simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, sparingly spiculous; tension spicula acuate, long, and slender; retentive spicula bidentate equi-anchorate, slender, minute, few in number. Skeleton. Diffusive and irregular; primary lines multispiculous; secondary lines very irregular, occasionally bi or trispiculous; spicula acuate, rather long. Interstitial membranes. Tension spicula rather abundant, acuate, variable in size; retentive spicula same as those of the dermal membrane, very few in number. Gemmules membranous, aspiculous.

*Colour.*—Dried, ochreous yellow.

*Habitat.*—Banff, Scotland, Mr. T. Edward.

*Examined.*—In the dried state.

This sponge coats the stems of *Tubularia* for the length of seven inches, at no part exceeding two lines in thickness. Its general aspect in the dried state is rough and irregular in consequence of the prominent hispitation of its surface, produced by the prolongation of the primary lines of the skeleton beyond the dermal membrane, frequently to the extent of the length of two or three times that of a spiculum. The oscula are not visible without the aid of a lens of an inch focus. The construction of the skeleton is very irregular and diffusive, and the secondary lines especially, and to such an extent as to frequently render it difficult to decide whether they are really secondary skeleton lines or dispersed skeleton spicula. The skeleton spicula are regularly acuate and rather slender. The retentive spicula are not visible in a fragment of the

sponge immersed in water, and it is only when mounted in Canada balsam that they can be distinctly seen *in situ* in the dermal membrane, on which they are not equally dispersed, but occur in clusters at intervals. In the interstitial membranes they are very few in number, and rarely more than one occurs in the field at the same time.

There is a considerable degree of resemblance in the descriptions of *I. Alderi* and *I. paupera* to that of *I. Edwardii*, which may possibly lead to a doubt in the mind of the student as to which of the three the specimen he might have under examination belonged; but a comparison of the spicula alone of these three species readily distinguish each from the other. The length of the spicula of *I. Edwardii* as compared with those of both *I. paupera* and *I. Alderi* is as seven to five, and although thus much longer, the diameter is less than either of the spicula of the other two species, and the form is much more purely acuate.

### 35. ISODICTYA LOBATA, *Bowerbank.*

*SPONGIA LOBATA*, *Montagu.*

Sponge. Parasitical, coating Zoophytes, &c., branching irregularly; branches short, lobate. Oscula simple, dispersed, few in number. Pores inconspicuous. Dermal membrane sparingly spiculous; tension spicula acuate, minute, and slender, dispersed, and some the same as those of the skeleton. Skeleton. Symmetrical near the surface, diffuse, and irregular internally; primary and secondary lines multispiculous; rete occasionally more than the length of one spiculum wide. Spicula acuate, short, and stout. Interstitial membranes. Tension spicula acuate, rarely cylindrical, slender. Retentive spicula inequi-dentato-palmato-anchorate and bihamate; bows of both the latter exter-umbonate.

*Colour*.—Dried, light yellow brown.

*Habitat*.—Coast of Devonshire, Montagu and Mrs. Griffiths.

*Examined*.—In the dried state.

The short description of this sponge by Montagu is very correct as far as it goes. Dr. Johnston never having had the advantage of seeing the type specimen has placed it in his 'History of British Sponges' as a synonym of *Spongia limbata*, but it differs from that sponge not only specifically but generically. The type specimen of Montagu, in the possession of Dr. Grant, consists of a number of short undivided lobate branches, rising irregularly from an ill-defined common central stalk. The branches seldom exceed half an inch in height, and the terminations are nearly hemispherical. The oscula are simple, irregularly dispersed, and rarely exceed three or four in number to each branch, one frequently being terminal. The whole surface of the sponge is porous, and the general texture is coarser and less elastic than that of *Chalina limbata* to which Johnston refers it. In a second specimen of this sponge, for which I am indebted to my kind friend, the late Mrs. Griffiths, the lobate character is evidently due to its being parasitical on a branching Zoophyte, the ramifications of which it has followed, but it has not entirely enveloped it. The specimen is nearly the same in size and general character as the type one, but not in so good a state of general preservation. The dermal membrane in the type specimen is nearly destroyed, but in the second specimen it is in good condition. A few of the skeleton spicula are distributed on its surface; the true tension spicula are minute and occur at intervals in patches of considerable numbers. I could not detect retentive spicula in any part of the membrane.

The symmetrical arrangement of the skeleton is less apparent towards the centre of the branches than it is near the circumference, where it becomes very regular; the primary or divergent lines being formed of spicula, all of which have their apices towards the external surface of the sponge; but in the secondary, or circumferential, and the

axial lines, the same regularity of disposition does not prevail. The slender acuate spicula of the interstitial membranes are comparatively few in number, and so are the inequi-anchorate and bihamate ones. Both the latter forms are very difficult of detection *in situ*, even after a section of the sponge has been mounted in Canada balsam; and it is only in the fragments of the membranes after having been partially acted on by boiling in nitric acid, that they are distinctly to be seen attached by the back of the bow. They are not symmetrically arranged, but are irregularly dispersed over the surface of the membrane. The dentato-palmato-anchorate spicula are perfectly and beautifully developed; the distal palm extends to nearly half the length of the spiculum, and the palm is wide and symmetrical in shape.

### 36. ISODICTYA PAUPERA, *Bowerbank.*

**Sponge.** Coating or parasitical; surface irregular, asperated. Oscula simple, dispersed, numerous. Pores inconspicuous. Dermal membrane simple, pellucid; furnished with dispersed minute bidentate equi-anchorate retentive spicula. Skeleton. Primary lines multispiculous; secondary lines bi or trispiculous; occasionally multispiculous; spicula sub-fusiform-acuate, stout. Interstitial membranes. Spicula fusiform-acuate slender; and bidentate equi-anchorate retentive spicula like those of the dermal membrane.

**Colour.**—Dry, light ochreous yellow.

**Habitat.**—Torquay, Mrs. Griffiths.

**Examined.**—In the dry condition.

I received thirteen fragments or specimens of this species from my late friend, Mrs. Griffiths, of Torquay, the largest not exceeding three fourths of an inch in diameter, and about a quarter of an inch in thickness. The whole of the specimens were much mixed up with extraneous matter,

principally Zoophytes, sometimes covering Lepralia, and at others embracing the stalks of Plumularia.

With a two inch lens the surface appears exceedingly rugged and hispid. The oscula are simple, irregular perforations, varying much in size, and very numerous in comparison with the small size of the specimens. The bidentate equi-anchorate spicula of the dermal membrane are irregularly dispersed, and are attached usually by the middle of the bow; they are very minute and require from 600 to 700 linear power to distinctly determine their bidentate character.

### 37. ISODICTYA UNIFORMIS, *Bowerbank.*

Sponge. Massive, sessile. Surface smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane abundantly spiculous: spicula acuate, dispersed, irregular in size. Skeleton. Rete very irregular and diffuse; primary lines multispiculous; secondary lines numerous, dispersed, and irregular, rarely more than unispiculous; spicula acuate. Interstitial membranes. Spiculous, same as those of the skeleton and dermis, numerous, dispersed.

*Colour.*—Dried, cream white.

*Habitat.*—Guernsey, Rev. A. M. Norman.

*Examined.*—In the dried state.

The structure of this species is exceedingly simple. The spicula are uniform in shape, and there is but one form in all parts of the sponge. I received two small specimens of the sponge from the Rev. A. M. Norman, who dredged them up off Guernsey. They were nearly of the same size and form, half an inch in diameter, and about two lines in thickness. The skeleton reticulations are very irregular, and open in their structure; the primary lines are multispiculous, and the secondary ones numerous and irregular, sometimes consisting of two or three spicula, at others

being formed of single spicula disposed closely adjoining each other, and at various angles to the primary lines of the skeleton, thus creating so much confusion as frequently to simulate the structure of a *Hymeniacidon*, when the section happens to be not quite at right angles to the surface. No retentive spicula could be detected in any portions of either the dermal or interstitial membranes.

### 38. *ISODICTYA CLARKEI*, *Bowerbank*,

**Sponge.** Parasitical, cylindrical. Surface even, minutely hispid. Oscula inconspicuous, few, dispersed. Pores inconspicuous. Dermal membrane pellucid, spiculous? tension spicula fusiformi-acuate, slender; retentive spicula dentato-palmate inequi-anchorate, very minute, few in number. Primary lines multispiculous, stout; secondary lines frequently multispiculous, ~~irregular~~; spicula fusiformi-acuate, short and stout. Interstitial membranes; tension spicula fusiformi-acuate, slender. Retentive spicula dentato-palmate inequi-anchorate, very minute, few in number.

**Colour.**—Dried, light brown.

**Habitat.**—North Shields, Dr. W. B. Clarke; Dundee, Mr. Gardener.

**Examined.**—Dried.

This species is parasitical on the main stem of a *Sertularia*, which it surrounds for three fourths of an inch in length, but it does not exceed two lines in diameter at any part. It has unfortunately been too much washed to afford us the whole of its structural characters in a satisfactory manner. The spicula in the skeleton are not very numerous, there being usually not more than two or three together; and the interstitial spaces are very large and open in comparison with the size of the sponge. The dermal membrane appears to have been entirely, or very nearly entirely, destroyed; there is a small membranous

surface at one portion of the sponge, but there is nothing in its appearance to distinguish it from a portion of the interstitial membranes, which have slender fusiformi-acuate spicula, and are still more sparingly furnished with small dentato-palmate inequi-anchorate spicula. The destruction of the dermal membranes and the expanded character of the interstitial spaces renders it impossible to determine with certainty, in this specimen, either the position or size of the oscula; but on viewing the sponge by direct light, with a power of 90 linear, they were apparently very little larger than the interstitial spaces, few in number, and irregularly dispersed. I am indebted to Dr. Clarke for my knowledge of this species, and I have therefore attached his name to it, in acknowledgment of the kind assistance I have at all times received from him, during my investigation of the British sponges, and of his zeal in the pursuit of Marine Natural History.

### 39. ISODICTYA GRACILIS, *Bowerbank.*

Sponge. Ramose, pedicelled; branches slender, dividing dichotomously or trichotomously, terminations attenuated. Surface even; minutely hispid. Oscula inconspicuous, simple, dispersed, minute. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton. Primary lines multispiculous; secondary ones usually unispiculous. Spicula acuate, small, and rather slender. External defensive spicula same as those of the skeleton. Interstitial membranes. Tension spicula acuate, slender, few in number. Retentive spicula bidentate equi-anchorate, minute, and very few in number.

*Colour.*—Alive, pale buff; dried, cream white.

*Habitat.*—Larne Lough, Ireland, Professor Dickie.

*Examined.*—In the dried state.

I am indebted to my friend, Professor Dickie, for my

knowledge of this sponge. He states it was dredged in six fathoms, in Larne Lough. It is two inches and eight lines in height. It has lost its natural base, but from the dense character of the tissues of its present one, it has evidently been separated very little above its original attachment. Four lines above its proximal termination there is the remains of a large branch, and the stem above is reduced from four lines in diameter to two lines, and at nine lines above this point it divides into three branches, and these again, one trichotomously, and another dichotomously, spreading laterally to the extent of two inches. The terminal branchlets gradually attenuate to points, more or less acute. At present the whole sponge is somewhat compressed, but as it has been dried on a slip of writing paper, it is probable that this compression is not a natural character. The surface is even, and very minutely hispid from the projection slightly beyond the surface of the distal terminations, of the primary lines of the skeleton. The oscula are not visible without the aid of a lens of about an inch focus. The skeleton spicula are small, but vary considerably in length and stoutness; the larger ones being these of the primary fasciculi of the skeleton, and these are frequently slightly flexuous. The tension spicula are minute and very slender, and are exceedingly few in number. The retentive spicula are also very small, and of very rare occurrence.

I subsequently received two more specimens of this species from my friend, Professor Dickie; they were united by the anastomosing of a branch from each. They very closely resembled in size and general character the specimen first described. One of them had its natural base, a very slight expansion of the sponge, on the surface of a small bivalve shell. They were also from Larne Lough, County Antrim, dredged in five fathoms.

**40. ISODICTYA BARLEEI, Bowerbank.**

Sponge. Sessile, or slightly pedicelled; irregularly fan-shaped, sometimes consisting of two or more foliations from the same base; foliations thick and fleshy. Surface even. Oscula simple, circular, about a line in diameter; congregated in circular or radiating groups, which are nearly equidistantly dispersed over the external surfaces of the sponge. Pores conspicuous, dispersed on the whole of the surface of the sponge. Dermal membrane spiculous. Spicula acuate, very slender, about as long as those of the skeleton, abundant, and often sub-fasciculated. Skeleton. Coarse and very diffuse; primary and secondary lines multispiculous. Spicula sub-flecto-acuate, short and stout. Interstitial membranes. Tension spicula same as those of dermal membrane.

*Colour.*—Alive, pale buff or yellow.

*Habitat.*—Haaf Banks, Shetland, Mr. Barlee and Mr. Humphreys.

*Examined.*—As from the sea, in salt and water pickle.

A single sponge of this species was dredged at the Haaf Banks, Shetland, by Mr. Barlee, in the year 1851, in from 60 to 90 fathoms. The natural base of the sponge was not obtained. The torn base was about two inches long, and from half an inch to an inch in thickness, so that probably the sponge may, when perfect, have had a short pedicel. It consists of three fans or leaves, of irregular sizes and proportions, and one of them, the tallest, is divided near its distal termination into two smaller, or secondary fans. The surface is nearly even, and the average thickness of the sponge is about half an inch.

The groups of oscula generally consist of a central one with from five to eight others around it, usually disposed in radiating lines. The groups are about equidistant from

each other, and they give to the surface on which they disposed a singular and very characteristic stellar appearance. The porous areas are large and distinct, and I found occasionally a large pore open in each ; but it is most probable that, in the living state, they would contain more than one in each area.

The general structural character of the skeleton is much more robust than is usual in this genus, and the spicula are correspondingly increased in size. In the dried state the colour is rather inclined to purple, or a dark amber colour.

I subsequently received portions of a second specimen from the same locality, from the Deep Sea Shetland fishermen, through the agency of Mr. Humphreys ; and this specimen had evidently been very similar in size and form to the one presented to me by Mr. Barlee.

I have appended the name of my late kind and liberal friend to this singular and very interesting species, as a slight acknowledgment of the many disinterested acts of kindness that I have received from him during the progress of this work, and as a token of respect for his indefatigable exertions in the pursuit of knowledge of Marine Natural History.

#### 41. ISODICTYA BEANII, *Bowerbank.*

Sponge. Encrusting, surface uneven. Oscula inconspicuous, dispersed ; numerous. Pores inconspicuous. Dermal membrane thin, pellucid, furnished with slender attenuato-acuate and tricurvate spicula, and very rarely, with minute anchorate retentive spicula. Skeleton rarely more than bi or trispiculose ; spicula sub-fusiformi-acuate, not spinous ; secondary lines somewhat confused, mostly unispiculose ; spicula acuate, entirely spined, short and stout. Interstitial membranes. Tension spicula attenuato-acuate, slender ; occasionally sub-spinulate ; and tricurvate spicula ; and very rarely, minute retentive anchorate spicula.

*Colour.*—Alive, red or crimson; dried, light green.

• *Habitat.*—Weymouth, Mr. Bean.

*Examined.*—In the dry state.

I am indebted to my friend, Mr. Bean, of Scarborough, for thy knowledge of this species. He states, "I received a large stone, covered with this sponge, from Weymouth; when fresh the colour was red or crimson." The piece I received was about an inch in length by three quarters of an inch in breadth, and it did not exceed the eighth of an inch in thickness at any part. The surface is very uneven, and bristling with spicula from the terminations of the radial lines of the skeleton, from the lines of the axes of which, they diverge at a slight angle when projected from the surface of the sponge. The oscula are visible by the aid of a lens of two inches focus; they are very numerous and rather equally dispersed, but are most abundant on the depressed portions of the surface.

The sponge has apparently been soaked in preparing it for the cabinet to such an extent in fresh water as to have destroyed nearly the whole of the dermal membrane, in the small portion of it that remains I could not detect many of the pores from the quantity of sarcode present, but they appear to be minute and not very abundant. The dermal membrane is translucent, and is furnished rather abundantly with slender attenuato-acuate and tricurvate spicula in about equal proportions; the minute anchorate spicula are very rare.

The smooth primary lines of spicula, of the skeleton are twice the average length of the spinous ones of the secondary lines of the skeleton, but the diameter is about equal in each. The anchorate spicula occur rarely on the interstitial membranes as well as on the dermal one; they appear in all cases to be attached by the central portion of the bow; the reverse is the case with the tricurvate spicula, which are always lying on their sides, their whole length being attached to the surface of the membrane; occasionally the latter form of speculum is seen intermixed with those of the skeleton.

42. *ISODICTYA LURIDA*, *Bowerbank.*

Sponge. Massive, sessile. Surface even, smooth. Oscula simple, dispersed, small and numerous. Pores inconspicuous. Dermal membrane abundantly spiculous; tension spicula cylindrical, occasionally sub-clavate, mucronate, or hastate; disposed sometimes in flat radiating groups, at others, parallel, in broad fasciculi; and also slender long acuate spicula, entirely spined, dispersed; retentive spicula bidentate equi-anchorate; dentes very long, shaft slender. Skeleton very diffuse and open; primary lines multispiculous, sinuous and irregular; secondary lines irregular, rarely more than bispiculous. Spicula sub-fusiform-acuate, basally and apically spined; spines few in number, minute. Interstitial membranes. Tension spicula acuate, very slender, sometimes flexuous, few in number; retentive spicula same as those of the dermal membrane; unequally distributed, sometimes numerous, dispersed, at other times entirely absent.

*Colour*.—Dried, dark nut-brown.

*Habitat*.—Three miles off Dunstanborough, Northumberland, Rev. A. M. Norman.

*Examined*.—In the dried state.

The specimen is irregularly massive, two inches in length, and one and half in width, and its greatest height is three fourths of an inch.

The dermal tissues of this sponge are very characteristic of the species; the abundant groups of radiating tension spicula, with the occasional occurrence of parallel bundles, render it unlike any other nearly allied species with which I am acquainted. The tension spicula of the dermal membrane are nearly equal in their length and diameter; but their terminations are subject to much variation in form, no two scarcely being alike in that respect. The

spicula of the skeleton are comparatively large and stout, and they vary considerably in the amount of their spination ; sometimes the spines are so few in number and so minute as to be scarcely discernible, while in others they are prominently and abundantly produced ; in almost all cases they are absent at the middle of the shaft, but occasionally the whole spiculum is entirely, but incipiently, spinous. It is a singular feature in this sponge, that, in the interstitial membranes, the retentive spicula are frequently absent for a considerable space, and then a single localised group will appear in which they are very abundant.

#### 43. ISODICTYA FIMBRIATA, *Bowerbank.*

Sponge. Massive, sessile. Surface smooth. Oscula simple, dispersed, numerous. Pores inconspicuous. Dermal membrane pellucid, abundantly spiculous ; spicula acerate, without spines, dispersed or subfasciculate ; abundantly and often profusely furnished with dispersed bidentate bifimbriate equi-anchorate retentive spicula, large and small. Skeleton. Strong and coarse ; primary lines multispiculous ; secondary lines irregular, mostly bi or trispiculous ; spicula acuate, stout and rather short in their proportions ; apically and basally spined ; occasionally entirely but incipiently spined. Interstitial membranes. Tension spicula acuate, long and slender, occasionally flexuous, few in number ; retentive spicula, bidentate bifimbriate equi-anchorate, large and small, dispersed, very abundant.

*Colour.*—Dried, nut-brown to dark purple.

*Habitat.*—Shetland, Mr. Barlee and Rev. A. M. Norman.

*Examined.*—In the dried state.

I am indebted to the kindness and liberality of my late friend, Mr. Barlee, for my first knowledge of this interesting

species; he obtained it during his deep sea dredging at Shetland. The specimen is a small, irregularly ovoid, tuberous mass, about half an inch in length, having an even surface, with numerous small oscula irregularly dispersed.

The Rev. A. M. Norman subsequently sent me nearly two dozen specimens of this species. The general form was nearly globular, or more or less oval. They varied in size from about that of a walnut to a large pea, and the colour of the dried specimens was uniformly a nut-brown. The tension spicula of the dermal membrane are very numerous, and are frequently so obtusely terminated at the apex as to be readily mistaken for cylindrical spicula by a hasty observer; they are generally irregularly dispersed, but are occasionally collected into loose, flat fasciculi; they are not spinous. The skeleton spicula are rather short and stout; they are profusely furnished with small, short, conical spines, especially at the base, while near the extreme apex they are frequently absent for the length of from once to twice the greatest diameter of the spiculum.

One of the most striking structural characters of this sponge is the profusion and large size of the anchorate spicula with which the inner surface of the dermal and both surfaces of the interstitial membranes are furnished. They are unequally dispersed over those membranes; in all parts they are abundant, and in some spots they are crowded closely together in great profusion. They vary greatly in size. In some of the smaller ones indications of the fimbriation of the shaft of the spiculum may frequently be observed; but in the larger forms it is strikingly visible by the aid of a microscopic power of about 150 linear. The pairs of fimbriæ on the sides of the shaft extend in length from near their distal terminations to within a short distance of the middle of its bow, always leaving a space of that portion of it, equal to about one fifth of its entire length, without fimbriation. In a fully developed spiculum, the lateral expansion of the fimbriæ is often to such an extent, that each considerably exceeds the

diameter of the shaft of the spiculum in width ; but this full amount of development varies in some spicula to that of scarcely an indication of its presence on the sides of its shaft. The fimbriæ are not connected with the dentæ of the anchorate spiculum. They originate at the bases of those organs, and the outer margin of each, curves gradually outward until it reaches to near its termination ; it is then rapidly inflected inward until it arrives at the shaft ; its greatest expansion being at about four fifths of its length, from its origin near the dental end of the spiculum.

The retentive spicula of both sizes are very abundant in the specimen from Mr. Barlee ; and they are remarkably illustrative of the general character and laws of development of these organs ; for in each set, their progressive growth from their earliest biaminate condition to the adult form may be readily traced by careful observation. The fibrillation of the shaft of the spiculum is remarkably delicate, and requires a careful manipulation of the light to render it distinctly apparent with a linear power of about 600.

SPONGILLA, *Linnæus.*

1. *Spongilla fluviatilis*, Johnston.
2. — *lacustris*, Johnston.

SPONGILLA LINNÆUS, *Lamarck and Johnston.*

HALICHONDRIA, *Fleming.*

1. SPONGILLA FLUVIATILIS, *Johnston.*

Sponge. Massive, sessile ; surface uneven, often lobular, hispid. Oscula simple, large, scattered. Pores conspicuous. Dermal membrane pellucid, aspiculous. Skeleton. Spicula acerate. Ovaria sub-globose ; spi-

culæ birotulate, short, rarely spinous; disposed in lines radiating from the centre of the ovarium; rotulae equal in size, flat, deeply and irregularly dentate, diameter equal to the length of the shaft of the spiculum.

*Colour*.—Alive, yellow or green.

*Habitat*.—Rivers and lakes of Great Britain; on old timber and branches of wood.

*Examined*.—Alive.

Dr. Johnston, in his ‘History of British Sponges,’ has given so able a digest of all that has been written regarding this species and its numerous changes of name, both generic and specific, as to render any observations on that part of my subject a work of supererogation.

The normal form of this species is certainly massive and sessile; and the arborescent form that it is said to occasionally assume is due to its having originally been parasitical on stems of plants, and, perhaps, also not unfrequently to *S. lacustris* having been mistaken for this species. When developed under favorable circumstances, I have seen large rounded lobes projected from its surface; but I have never seen it assume an arborescent form like that of *S. lacustris*.

The absence of spicula in the dermal membrane of this species readily distinguishes it from *S. lacustris*; but the most striking differential character exists in the birotulate spicula of the ovaria, the correct form and position of which were, I believe, first pointed out by Meyen in Valentin’s ‘Repertorium,’ 1840.

The shaft of the spiculum is usually smallest at the middle, and it increases more or less as it approaches the rotulæ; and, occasionally, but rarely, we find a single large spine projecting at right angles from near its middle. The rotulæ are flat and deeply and irregularly divided; the divisions frequently extending from the circumference to very near the centre. They are disposed very closely together in the walls of the ovaria; the outer rotula supporting the external

membrane, and the inner one performing the same office for the internal membrane; but they are so completely covered by the respective membranes, that without the application of nitric acid they would be extremely likely to escape observation.

Much uncertainty appears to have existed among our early writers on Natural History regarding the number of our native species of *Spongilla*. Ray (Syn. Stirp. 30) notices two species under the designation of "*Spongia ramosa fluvialis*" and "*Spongia fluvialis ramosa fragilis*." Charles Stewart, of Edinburgh, in his 'Elements of Natural History' (vol. ii. p. 420, published in 1802), describes one species in the following terms:—" *Spongia lacustris*. Creeping on other bodies and taking their figure; brittle, with erect, round, obtuse branches. Inhabits England, Sweden, &c. This species is found in lakes and rivers; it has a strong peculiar smell; when young, flat; when old, putting forth branches. In autumn it contains little globules, like seeds, which explode when put into the flame of a candle."

Fleming, in his 'History of British Animals' (p. 524, published in 1828), describes two species under the generic designation of *Halichondria*:—" *H. fluvialis*. Soft, brittle, and slenderly fibrous when dry; spicula linear and doubly pointed.—*H. lacustris*. Hard, brittle, and coarsely fibrous; spicula linear and doubly pointed." Dr. Johnston, in his 'History of British Sponges and Lithophytes' (published in 1842), adopts the two species established in Fleming's work, but restores them to Lamarck's genus *Spongilla*.

Dr. Fleming was perfectly right in referring the British Spongillas to the genus *Halichondria* as then constituted, as in the anatomical structure of their skeletons they do not differ in any respect from a very considerable number of British Sponges which were then included in that genus, but which I have now found it necessary to arrange separately in the genus *Isodictya*, and with which genus, as far as regards the peculiarities of the structure of the skeleton, they are still identical; but they differ from it materially in their reproductive organs. In *Isodictya*, the mode of

reproduction is by internal gemmulation, while in *Spongilla* the same vital function is always exercised through the medium of ovaria; and in these organs a peculiar structure and class of spicula prevail which are never found in the reproductive organs of any of the species of the marine genus *Iodictya*.

Although Dr. Johnston adopted the two British species as described by Dr. Fleming, he still retained doubts as to their being in reality more than one; and it was not until I had made careful microscopical examinations of the ovaria of each that their distinctive specific characters were determined to my own satisfaction.

## 2. SPONGILLA LACUSTRIS, *Johnston.*

*EPHYDATIA CANALIUM*, *Fleming.*

*HALICHONDRIA LACUSTRIS*, *Fleming.*

**Sponge.** Sessile, branching; surface more or less hispid. Oscula simple, dispersed, small, and numerous. Pores inconspicuous. Dermal and interstitial membranes pellucid, spiculous; spicula numerous, fusiformi-acerate, entirely spined; spines abundant, conical, acute. **Skeleton.** Spicula subfusiformi-acerate. Ovaria sub-globose; spicula acerate, much and variably curved, disposed at right angles to lines radiating from the centre of the ovaries, entirely spined; spines conical, acute.

**Colour.**—Dark green.

**Habitat.**—Lakes and rivers of England and Scotland.

**Examined.**—In the living state.

Much uncertainty has existed regarding the specific distinctions belonging to the two well-known European species of *Spongilla*; and I can only attribute this indecision on the part of naturalists to their having hitherto appealed to the characters of external form and substance

as a means of discrimination to the almost total exclusion of those of internal structure, in which may be found striking and unfailing specific differences which never vary under any circumstances of locality or modification of external form.

Dr. Fleming has justly characterised this species as being "massive, rising into short rounded branches; the fibres are coarser and the substance denser than those of *S. fluvialis*; the spicula, too, though similar in form, are thicker and about one fourth shorter." This description when both species are attainable, is good as regards the differential characters: but, fortunately, there are essential characters of much higher value, which exist in the spicula of the dermal membrane and in those of the ovaria, neither of which have, I believe, been noticed by previous writers on these subjects. Those of the dermal membrane are, under ordinary circumstances, very indistinct. If we examine the membrane in water between glasses, the spicula, as they lie immersed in the sarcode, are scarcely to be detected; but if previously mounted in Canada balsam, they become at once distinctly visible; they are very numerous, and are disposed over the membrane without any approximation to order and have an average length of  $\frac{1}{4}$  and inch, and are  $\frac{1}{33}$ rd inch in greatest diameter. They vary to some extent in their dimensions, but their form is always fusiformi-acerate; the spines are abundant, conical, and acutely terminated at all parts of the spiculum, but they are not very strongly produced. The interstitial membranes are also plentifully supplied with the same description of tension spicula as those of the dermal membrane. The dermal membrane of *S. fluvialis* is aspiculous, and in this character, therefore, we possess an organic difference in the structure of the parts, which leads us at once to a definite and correct mode of determining the species, however closely they may simulate each other in form.

The skeleton spicula also differ in form from those of *S. fluvialis*; in the latter they are purely acerate, that is, having the same diameter throughout the greater portion of the shaft of the spiculum, and attenuating only towards

the terminations ; while in the former the spicula are stouter and shorter in their proportions, and the attenuations commence at or very near the middle of the shaft of the spiculum, and are, therefore, fusiformi-acerate in shape.

But the greatest organic difference between this species and *S. fluvialis* exists in the spicula of the ovaries. In the latter, the case of that organ is strengthened and supported by a number of birotulate spicula, the rotulæ supporting the inner and outer surfaces of the case of the ovary, the shafts of the spicula being disposed at right angles to the surfaces ; while in *S. fluvialis* the walls of the ovary are totally destitute of birotulate spicula, but in their place we find a considerable number of curved, acerate, spinous spicula, not disposed at right angles to the surface of the gemmule, but imbedded in and lying parallel to the surface of that organ, thus affording a specific distinction so strikingly different from the corresponding structures in *S. fluvialis* as to render the discrimination of the species easy and certain whenever the ovaries are present.

This species occurs plentifully at the bottom of the West Country Timber-dock, on the south side of the Thames, near Rotherhithe. It may frequently be found attached to the lower part of the large mooring-posts near the central parts of the docks, about eight or ten feet deep. I have never found it in this locality in shallow water or near the surface like *S. fluvialis*, which is also abundant in the same dock attached to the floating timber. On the contrary, at Cookham, a few miles beyond Maidenhead, this species is abundant on the posts and sides of the wharfing-boards ; and here it is always found near to the surface of the water, and has a very fine emerald-green colour.

**DESMACIDON, Bowerbank.****SECTION \* Skeleton spicula, acerate.**

1. *Desmacidon fruticosa,*
2. — *Jeffreysii,*

**SECTION \*\* Skeleton spicula, acuate.**

3. *Desmacidon Peachii,*
4. — *constrictus,*

**SECTION \*\*\* Skeleton spicula, spinulate.**

5. *Desmacidon ægagropila.*

**1. DESMACIDON FRUTICOSA, Bowerbank.**

**HALICHONDRIA FRUTICOSA, Johnston.**

Sponge. Sessile, massive, and roughly latticed, or massive, with large projecting cloacal fistulæ. Fistular cloacæ very large and deep. Oscula simple, numerous; on the surface in young specimens, or on the parietes of the cloacæ, when they are present. Surface hispid. Pores inconspicuous. Dermal membrane pellucid, spiculous; tension spicula acerate, dispersed, not numerous; retentive spicula of sarcodous surface bihamate, simple, and contort, variable in size, very numerous; and also bidentate equi-anchorate, large and small, few in number, comparatively. Skeleton. Fibre stout and numerously spiculous; spicula acerate or occasionally inequi-acerate. Interstitial membranes.

Tension and retentive spicula the same as on the dermal membrane.

*Colour.*—Alive, orange yellow.

*Locality.*—Fowey, Mr. C. W. Peach; Diamond Ground, off Hastings, and South Coast of England, not uncommon. J. S. Bowerbank.

*Examined.*—In the living state.

I am indebted to my indefatigable friend, Mr. Peach, for two fine specimens of this sponge, which were found at Fowey. The largest is eight inches in length and three in width; it has the appearance of a confused and much inosculating bundle of nearly parallel branches, and has no remains of its base. The second specimen from Fowey was about five inches long by two in breadth, nearly compact, and without the inosculating character of the first one. I have also since received numerous specimens from the trawlers at the Diamond Ground, off Hastings. They are attached indifferently to pebbles, the shells of oysters, or *Pecten maximus*. They vary exceedingly in form and size, sometimes being massive and compact in structure, and at others assuming the form of numerous large cloacal fistulæ. One very large and fine specimen is nine inches in length, four inches wide, and five in height, with eight or nine basal points of attachment, and it has more than a dozen large fistular lobes projected from its mass, in an upward direction, each terminated by a single large orifice; the lobular masses varying in height from one to four inches, and the cavities and terminal orifices from a quarter to nearly an inch in diameter. In the living state it is tolerably solid; and in drying, or when washed in fresh water, a great quantity of gelatinoid sarcode runs from it. In the living state it is of a bright orange-yellow colour, but when dried it usually assumes a light gray tint.

The dermal and interstitial membranes are tolerably well preserved; they are abundantly supplied with tension spicula, disposed without any approximation to arrangement. The variety and irregularity in the size of the

spicula is very remarkable. The skeleton spicula are acerate; they have frequently one end more abruptly attenuated and more bluntly terminated than the other, presenting occasionally a form intermediate between the regular acerate and acuate spiculum. The spicula of the membranes are also sometimes inequi-acerate, but they are more slender than those of the skeleton. The greater portion of the anchorate and bihamate spicula of the membranous structures are comparatively small, but exceedingly numerous; they are irregularly dispersed over all parts of those tissues. The larger spicula of these forms are frequently four or five times as long as the smaller ones, but they are comparatively few in number.

Montagu's observations, as quoted by Dr. Johnston in his 'History of British Sponges,' is very descriptive of the general character of the species.

## 2. DESMACIDON JEFFREYSII, *Bowerbank.*

Sponge. Massive, sessile, uneven; furnished with numerous large and small penicellate tubular cloacæ. Surface smooth. Oscula within the cloacæ. Pores inconspicuous. Dermal membrane pellucid, furnished with a unispiculous reticulation, spicula same as those of the skeleton. Skeleton. Stout, coarse and elongately diffuse; spicula acerate, rather short and stout. Interstitial membranes abundantly spiculous; spicula same as those of the skeleton, dispersed. Gemmules membranous.

*Colour.*—Dried, light buff yellow.

*Habitat.*—Shetland, Mr. C. W. Peach.

*Examined.*—In the dried state.

This fine species was dredged at Shetland in 1864, by Mr. J. G. Jeffreys, and preserved for me with many other interesting specimens, by my friend Mr. C. W. Peach, who accompanied the expedition. I have no certain information regarding the correct size or configuration of the specimen,

as it was cut into numerous pieces by the dredge, which appears to have taken it from a nearly level surface. Some of the pieces of the basal portion are about two and a half inches in diameter, and several others somewhat less, and when placed closely together they fill a space of not less than seven inches square, and besides these fragments there are nearly twenty large cloacæ, for which no positions are apparent on the pieces of the basal masses of the sponge in my possession; the probability therefore is, that in its perfect condition it would have exhibited a surface equal to at least a foot or fourteen inches in diameter. The thickest fragment of the basal mass does not exceed about an inch. I could not detect oscula on any parts of the massive base of the sponge.

From this basal mass numerous penicellate tubular cloacæ spring, varying from half an inch in height and two lines in diameter, to four inches in height and three fourths of an inch in diameter at the base, usually decreasing gradually in size to the distal extremity, and terminating in a contracted, apparently permanent, orifice. The central tube at the base, in large specimens, frequently exceeded four lines in diameter. In one case the base was dilated into the form of a hydrometer bulb, exceeding an inch in diameter. The parietes were very thin, and the cloaca at the base springing from the top of the bulb was only four lines in diameter, and continued of that size to very near its distal termination, at rather more than two inches in height; the central cavity was open throughout; this variation in form is evidently abnormal.

In the perfect sponge the number of these organs must have been very considerable, as I have the remains of more than thirty of them of various sizes, and in one fragment of the sponge, about three inches in diameter, there are eight of them of various sizes. The smaller tubes all appear to be simple, but the larger ones occasionally throw off one or two short tubular branches. The parietes of the larger cloacal tubes is frequently a quarter of an inch thick at the base, and it gradually becomes thinner to its distal extremity, where it is not thicker than a sheet of paper.

The reticulated dermal membrane is very characteristic in this species ; it is closely and compactly constructed ; the sides of the network appear never to exceed a single spiculum in length, and the areas are usually triangular or quadrangular. The fibres of the skeleton are very stout, and the areas of the network are usually very much elongated. The tension spicula of both the dermal and interstitial membranes are precisely the same as those of the skeleton ; they are very abundant in the latter membrane. The membranous gemmules were very abundant on the interstitial membranes in the basal mass of the sponge, but I did not detect any in the substance of the large cloacæ.

### 3. DESMACIDON PEACHII, *Bowerbank.*

Sponge. Massive, sessile, compressed, somewhat fan-shaped. Surface even but rough. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane profusely spiculous ; tension spicula, acerate, varying greatly in length, and of extreme tenuity, dispersed, exceedingly numerous : retentive spicula, bihamate simple, contort, and reversed ; dispersed, occasionally fasciculated, slender, very numerous. Skeleton. Coarse and open in its texture, fibres stout ; spicula acuate, large and rather long. Interstitial membranes profusely spiculous ; spicula the same as those of the dermal membrane.

*Colour.*—Dried, light brown.

*Habitat.*—Shetland, Mr. C. W. Peach.

*Examined.*—In the dried state.

I am indebted to my friend Mr. Peach for this species. The only specimen I have seen is four inches in height, three inches in its greatest breadth, rather exceeding an inch in thickness at the base, and six or seven lines thick at the distal margin ; it is compressed equably, and is obliquely fan-shaped. Nearly the whole of the dermal mem-

brane has been destroyed, and the present surface is rugged and very open. Under these circumstances the oscula are not readily detected, and they do not appear to have been either large or numerous, although the surface is thus dilapidated; in the patches of dermal membrane which remain the characteristic spicula are *in situ* and in a fine state of preservation, but it is in the interstitial membranes, which are in excellent condition, that the tension and retentive spicula are to be seen in their natural state. The tension spicula are thickly felted together on its surface; they are very minute and slender, and their length is frequently not more than a third or a fourth of that of one of the bihamate retentive spicula. Among the short slender tension spicula there are frequently other acerate spicula of three or four times their length, and these are still more slender than the shorter ones. The retentive spicula are slender but much expanded, and their form is exceedingly variable and frequently distorted, and some of them are of greatly increased strength in the shaft. The greater portion of them are irregularly dispersed among the tension spicula, but occasionally they are found congregated in fasciculi, and in this state their curves are conformable.

I have dedicated this interesting species to my friend Mr. Peach, whose ardour and ability in the pursuit of natural history is so well and so favorably known to naturalists, and to whose kindness and generosity I am indebted for this and many other new and valuable specimens described in this work.

#### 4. DESMACIDON CONSTRICTUS, *Bowerbank.*

Sponge. Sessile, fan-shaped (?) Surface, Oscula, and Pores unknown. Dermal membrane aspiculous? Skeleton, Stout and open; spicula sub-fusiformi-acuate, constricted near the base, long and large. Interstitial membranes sparingly spiculous. Tension spicula very minute acerate or acuate; retentive spicula, simple and contort bihamate very minute.

*Colour*.—Dried, light gray.

*Habitat*.—Shetland, Mr. C. W. Peach.

*Examined*.—In the dried state.

This sponge was sent to me with many others by my friend, Mr. Peach. It was dredged by Mr. J. G. Jeffreys at Shetland in 1864. It is but a fragment, about two inches high, based on the remains of a Coral, and is so completely water worn that very few of its specific characters are available for description. I have stated that the dermal membrane is aspiculous, but it is really very doubtful whether the minute portion of membrane remaining at the present surface of the sponge is truly dermal, or is interstitial; the latter membrane, fragments of which remain in good preservation in the interior of the sponge, is undoubtedly spiculous, and the presumption is that the dermal one would likewise be so. Indecisive as the other characters are, those of the spicula of the skeleton are perfectly demonstrative. They are not only unlike those of any known species of *Desmacidon*, but are unknown in any other British sponge. They are large and long, somewhat slender, and slightly fusiform; but their peculiarity consists in an irregular constriction of the shaft near its basal extremity. This commences at about one diameter of the largest part of the shaft from the extreme base, and continues for from one to three diameters up the shaft, which then gradually increases in its diameter, as in the usual form of a fusiform spiculum. The sudden constriction of the shaft near its base gives that portion of it the appearance of an elongo-curvato-spinulate termination; but in some of the spicula where the constriction is absent or very slightly produced, the spinulate character is entirely obsolete. The space of constriction is not always of equal diameter, and sometimes one or two minor constrictions are observable in its length. I could not detect the tension and retentive spicula of the interstitial membranes either among the spicula, separated by the aid of boiling nitric acid, or in portions of the sponge mounted in Canada balsam; the sarcodes on the surfaces entirely concealing them; but in

minute portions of the membranes remaining undissolved and very transparent among the spicula after the application of nitric acid, they were unmistakably visible, but not sufficiently so to determine accurately whether the form was acuate or acerate, although submitted to a linear power of 660.

### 5. DESMACIDON ÆGAGROPILA, *Bowerbank.*

*HALICHONDRIA ÆGAGROPILA*, *Johnston.*

Sponge. Sessile, massive or coating. Surface rugose or corrugated. Oscula simple, dispersed, large. Pores inconspicuous. Dermal membrane spiculous; spicula fusiformi-acuate, or sub-clavate, dispersed, occasionally sub-fasciculate, very numerous, and with simple contort, and reversed bihamate spicula; rarely with bidentate inequi-anchorate, and tricurvate spicula. Skeleton. Spicula fusiformi-acuate or sub-clavate. Interstitial membranes. Tension spicula same as those of the skeleton, dispersed or sub-fasciculate. Retentive spicula same as those of the dermal membrane; sometimes few in number, at others remarkably abundant.

*Colour*.—Alive, red; dried, light cream yellow.

*Habitat*.—Coast of Cornwall, Brighton and Hastings, J. S. Bowerbank; Guernsey and Herm, Rev. A. M. Norman.

*Examined*.—In the living state.

At the first glance this sponge may, in the dried state, be readily mistaken for *D. fruticosa*, which it sometimes closely resembles in its external form and characters, but the difference in the form of the spicula readily distinguishes them. The specimens from both the localities I have named are all (six) of them parasitical on small Fuci, enveloping the stem and branches, and forming an irregular

mass ; the largest is about three inches long by one and half-inch wide. The surface in the dry state is exceedingly rugged, irregular, and cavernous, and the oscula are numerous, large, and irregular in form. The dermal membrane is somewhat thick and opaque, and it is only after having been mounted in Canada balsam that the whole of the spicula with which it is amply furnished can be distinctly seen. The acuate or sub-clavate spicula agree in their proportions in all parts of the sponge, so also do the bihamate ones ; the latter are exceedingly numerous, and, comparatively speaking, are very large ( $\frac{1}{35}$ th inch in length) ; they are dispersed on the membranes without any approximation to a regular arrangement. The tension spicula are very numerous, and in the mode of their disposition they often very closely resemble the similar organs in a *Hymeniacidon*, so that they appear to form, as it were, a secondary skeleton very closely resembling that of a species of that genus.

The habit of this sponge is frequently very like that of *Isodictya fucorum*, especially on our southern coast, where it is often found enveloping the branches of *Rhytiphlæa pinastroides* ; but the colour and texture of the two species will readily distinguish them.

A specimen sent to me by the Rev. A. M. Norman has assumed the coating form. It is an irregular patch of sponge, about four inches in diameter, and very little more than half an inch in thickness, and is of the usual cream colour when in the dried state. It was found at Guernsey. A fragment of another specimen, three quarters of an inch in length, and five lines in thickness, from the same gentleman, was of a dark brick-red colour. It is very full of sarcodes, and has probably its natural colour remaining. In a thin slice from this specimen I found what has every appearance of being one of its gemmules. It was membranous, aspiculous, and spherical, and measured  $\frac{1}{37}$ rd inch in diameter. It was deeply imbedded in the sarcodes, and it was the only one I found ; I have thought it better not to include a description of it in the specific character.

A specimen found encrusting a small boulder of granite

by the Rev. Mr. Norman at Herm between tide marks, was thinly spread over its surface, covering all its inequalities, without exhibiting any disposition to rise from the surface on which it reposes; in this state the skeleton does not resemble those of the allied species of the genus; the fibres do not exhibit a disposition to anastomose and form an irregular reticulated tissue, as in those sponges; they originate from the basal membrane in a remarkable manner; springing from the centre of a radiating group of spicula, and frequently gradually attenuating and terminating acutely without anastomosing with any of the neighbouring fibres, but when they happen to meet they unite. The spinulation of the skeleton spicula is frequently very slightly produced, and in some cases they might almost be termed acuate, but there is always more or less inflation of the base, especially in the immature spicula. In this condition, and compared with the well-developed specimens of the same species, this sponge might readily be mistaken for a distinct species.

*RAPHYRUS, Bowerbank.*

1. *RAPHYRUS GRIFFITHSII, Bowerbank.*

*HALICHONDRIA GELATA, Johnston.*

Sponge. Sessile, massive; surface even. Oscula simple, dispersed, very numerous. Pores inconspicuous. Dermis coriaceous, stout, crowded with spicula; spicula acuate and spinulate, slender, very variable in form. Skeleton. Fibres very large and strong, irregularly dispersed; spicula subfusiform-spinulate, and rarely, acuate; stout. Interstitial membranes thick, abundantly spiculous; spicula subfusiform spinulate or acuate, long, and slender.

*Colour*.—Alive, bright yellow to orange; dried, dark brown.

*Habitat*.—Torbay, Mrs. Griffiths. Shetland, Captain Thomas, R.N., and Mr. McAndrew. Coast of Cornwall, Mr. Beach. Caldy Island, near Tenby, Mrs. Brett. British Channel, J. S. Bowerbank.

*Examined*.—In the living state.

I am indebted to the late Mrs. Griffiths for the first good specimen I saw of this fine and very singular species, and I have, therefore, dedicated it to that accomplished and most indefatigable naturalist, who first recognised it as a new and distinct species. It was brought up with the hook by a fisherman near Berry Head, Torbay. I have subsequently received specimens from my friends Captain Thomas, of the Hydrographical Survey, and Mr. McAndrew, both of whom dredged it off Shetland. Mr. Peach also sent it to me from the Cornish Coast, and I have obtained numerous fine specimens from the Hastings fishermen from the British Channel; most of these are based on large rolled flints; the largest specimen when dry measured ten inches long, three and a half thick, and six inches in height; and I am informed by my kind friend Mrs. Brett of Tenby, that she has received a specimen dredged by the fishermen at the back of Caldy Island, nearly two feet in length, six inches in height, and two inches in thickness. In the skeleton of this sponge there is no approach to definite arrangement, the stout polyspiculous fibres anastomosing frequently and in every direction; near the exterior they often assume a lamellar form, and at the surface the skeleton expands into a lamellated network or dermal coat, the areas being closely packed, and nearly equi-distant; they vary from half a line to three lines in diameter, while the intervening skeleton structure seldom exceeds a line in breadth. Each of the areas are furnished with a thick coraceous veil, which in some cases is perforated in the centre by a single large osculum, which has apparently the power of dilating or contracting. Sometimes the osculum when in a complete state of expansion appears as a thinly

margined simple orifice; at other times there is a central conical elevation of the membrane with a very small orifice at the apex, while in other cases the membrane is gathered thickly and closely together in the centre of the area, so that no orifice appears. When not occupied by an open osculum the area assumes the appearance of a tense membrane, and frequently has from one to five or six small pores which are barely visible in the dry condition by the aid of an inch lens, so that there is every reason to believe that in the live state it would be found that when not occupied by an osculum, they were regularly furnished with pores.

In a tuberous specimen from Mrs. Griffiths, about the size and form of half a large cocoa-nut shell, each prominence was terminated by one or more large open oscula, which did not appear to be furnished with a membrane as in the smaller and more regularly dispersed oscula. This specimen is the only one in which I have observed such large and expanded organs of this description.

The interstitial spaces beneath the dermal areas are sometimes very large, extending to nearly half an inch in depth, and from three to four lines in breadth. Occasionally they are divided into three or four secondary spaces by membranous structure, but at other times they are complete spaces, more or less abundantly lined with sarcode.

The coriaceous structure of the dermal areas is crowded with spicula which frequently assume a fasciculated appearance, but this is not the case with the interstitial membranes of the mass, which vary considerably in the quantity of spicula they contain, and they are always irregularly dispersed through the structures. The whole of the membranes are thickly covered with sarcode.

I could not detect the dermal membranes separate from the stout integuments of the surface; the whole of its substance is crowded with spicula irregularly mixed together. The spicula of the skeleton and those of the dermis and interstitial membranes are of nearly the same length and form, the only essential difference is, that the diameter of those of the former is much greater than that of the latter. Their spinulation is exceedingly variable, passing from purely

acuate through every imaginable variation of the spinulate form.

\* This sponge is undoubtedly Dr. Johnston's *Halichondria celata*, "var. a. massive and wide." The small piece I received in a letter from my friend for the purpose of the delineation of its spicula which are represented by fig. xiii, page 127, of his 'History of British Sponges,' sufficed only for the purpose for which it was transmitted, and it is not a matter of surprise that it should have been confounded with Dr. Grant's *Cliona celata*, the spicula of the two species being so very similar in size and form; but in other respects, as in the form of the skeleton structures, the species are widely separated from each other.

### DIPLODEMIA, *Bowerbank.*

#### 1. DIPLODEMIA VESICULA, *Bowerbank.*

Sponge. Sessile, massive. Surface, Oscula. Pores, and Dermal membrane unknown. Primary skeleton; fibre branching and inosculating, smooth, cylindrical; heterospiculous; spicula few in number, acerate. Secondary reticulated spiculous skeleton; filling up completely the interstices of the primary fibrous ones; rete rarely more than unispiculous; spicula same as those of the primary skeleton. Ovaries attached to the primary skeleton, oval or ovoid, membranaceous, thin, abundantly spiculous; spicula dispersed or subfasciculate; acerate, equal in size and proportions to those of the skeleton.

*Colour.*—Dried, gray.

*Habitat.*—Shetland, Mr. Barlee.

*Examined.*—In the dried condition.

This remarkable sponge was obtained by my friend Mr.

Barlee, during his deep sea dredging at Shetland, in 1858. It encrusts a portion of the valve of a *Pecten*, covering a space about half an inch in length and the eighth of an inch in breadth, and it does not exceed half a line in thickness. The ovaries are numerous and closely packed together, and are distinctly visible with the unassisted eye, looking like very minute yellow cocoons of some terrestrial insects, and were nearly thirty in number, on an area equal to about a quarter of an inch. The whole sponge is remarkably curious, forming a structural link between two hitherto distinct tribes of Sponges; that is, the genus *Spongia*, with its solid cylindrical keratose fibre, and the *Halichondraceous* tribe of sponges, with their purely reticulo-spiculous skeletons.

The fibrous portion of the skeleton is very peculiar in its character. It is smooth and cylindrical, having an axial line of, generally speaking, single spicula, uniting at their points, running throughout its whole length; but when of more than ordinary diameter, there are frequently other spicula at intervals, imbedded in the fibre parallel to the axial series. Throughout the whole length of the fibres at short intervals, there are similar spicula to the axial ones, imbedded at right angles to their axis, and projecting from the surface for half or more than half of their length. Some of these projecting spicula originate small lateral branches of the keratose skeleton, but by far the greater portion of them are the connecting points of the keratose fibres, and the reticulated portion of the skeleton, the former being thus completely imbedded amidst the latter.

The ovaries are attached by the sides to one or more branches of the fibrous skeleton, and they are also intimately connected with the reticulated skeleton by the uniting of the spicula of the latter with those of the surface of the ovary. The wall of the ovary is very thin, and appears to consist of a single membrane, profusely furnished with spicula which cross each other in every direction, and occasionally appear to assume a somewhat fasciculated arrangement. They are not uniform in shape, some being regularly oval, while others are more or less ovoid. I could not

detect any trace of a foramen in those subjected to examination.

### ORDER III.—KERATOSA.

*Genus—SPONGIONELLA, Bowerbank.*

#### 1. SPONGIONELLA PULCHELLA, *Bowerbank.*

*SPONGIA PULCHELLA, Sowerby.*  
— — — *Johnston.*

Sponge. Fan-shaped, lobular; sessile. Surface smooth and even. Oscula simple, dispersed, minute. Pores inconspicuous. Dermal membrane aspiculous, pellicular. Skeleton. Fibres very slender, reticulation very minute. Sarcodes abundant, dark amber coloured.

*Colour.*—In the dried state, brown.

*Habitat.*—Coast of Ireland, Mr. Robert Brown. Northumberland, (?) Mr. A. Hancock.

*Examined.*—In the dried state.

The type specimen of this sponge, which I had from Mr. James de Carl Sowerby, was described and figured by his father in the 'British Miscellany,' page 87, plate xliii. It was found on the Coast of Ireland, and he obtained it from the late Mr. Robert Brown. Unfortunately, the specimen has been so thoroughly washed as to have destroyed all other characters than those of external form, and of the skeleton.

The sponge is fan-shaped, with several additional smaller lobes springing from near the base of the larger one, which would fill a semicircle of nearly three and a half inches in

diameter, the thickness rarely exceeding two lines. The natural base has been destroyed, but it does not appear to have exceeded half an inch in length. The primary skeleton fibres radiate from the base towards the distal margins of the sponge; they are very minute and nearly uniform in diameter. The secondary fibres are somewhat irregular in the mode of their disposition; but they are usually nearly at right angles to the primary ones, and are very nearly as large in their diameter. The whole texture of the skeleton is very symmetrical and uniform. The oscula in the type specimen are not readily distinguishable; there are indications of a few small ones near the distal margins of the sponge. There are no remains of dermal membrane or sarcodite in the type specimen.

Mr. A. Hancock kindly sent me up for examination two specimens of the sponge. The first one examined, the larger of the two, was one and a half inch in height by an inch in width. Massive, with projecting lobes, each of which has an osculum at its termination about half a line in diameter. The dermal membrane was pellucid, and was thickly coated with dark amber-coloured sarcodite, including much granular extraneous matter; the fibre was also coated with sarcodite, but no spicula were apparent in any part of the sponge.

I have a young specimen of this sponge coating part of a small bouldered granite pebble, dredged by Mr. Jeffreys off the Outer Skerries, Shetland, in May, 1864, from fifty to eighty fathoms depth, and preserved for me by Mr. Peach. It is oval in form; and its greatest length is not quite half an inch, and its extreme thickness about two lines. It is in a fine state of preservation, and has the dermal membrane perfect, and in each of the dermal areas there are from five to eight pores in an open condition.

**CHALINA, Grant.**

## SECTION \* Skeleton spicula, acerate.

1. *Chalina oculata*, Bowerbank.
2. — *cervicornis*, Bowerbank.
3. — *Montaguii*, Bowerbank.
4. — *Flemingii*, Bowerbank.
5. — *gracilenta*, Bowerbank.
6. — *limbata*, Bowerbank.
7. — *Grantii*, Bowerbank. •

## SECTION \*\* (?) Skeleton spicula, acuate.

8. *Chalina seriata*, Bowerbank.

1. **CHALINA OCULATA, Bowerbank.**

**HALICHONDRIA OCULATA, Johnston.**

**SPONGIA LEVIGATA, Montagu.**

Sponge. Pedicelled, branching variously, occasionally palmate or digitate, branches round or compressed; surface even. Oscula small, slightly elevated, often arranged in lines on one side of the branch. Pores inconspicuous. Dermal membrane sparingly spiculous; spicula acerate, slender. Skeleton. Symmetrical; spicula sub-fusiformi-acerate, short and stout. Interstitial membranes nearly obsolete, sparingly spiculous; spicula acerate, slender.

**Colour.**—Alive, yellow, with a tint of green.

**Habitat.**—Coasts of England, abundantly, J. S. Bowerbank.

**Examined.**—In the living state.

The skeletons of this sponge are thrown up abundantly on the shores of almost every part of the British coast, but they are rarely found under such circumstances in good condition. In this state they are of a light yellow colour, and are very flexible, excepting near the basal portions. They vary in height from a few inches to more than a foot, and no two of them are alike in the ramification of their branches.

In a specimen of the sponge in this condition, rather exceeding a foot in height, a transverse section of the stem an inch above the base, had the keratose fibre very strongly developed, and in many parts it was swollen into large round or oval tuberous masses, from which stout keratose fibres emanated. At three inches from the base these tuberous masses were increased both in number and in size, and the stem up to this point being as hard and rigid as a stem of wood. At six inches from the base, the keratose concretions were very few in number, but the fibres were still stout and short, but cylindrical in form, and the sponge very much more soft and flexible; at nine inches from the base the diameter of the fibres was little more than half that of those at six inches, and at every inch upward it progressively decreased in size, until at the extreme end of the sponge, although still maintaining its fibrous character, the quantity of keratode was so small as to render it doubtful whether the section represented a Chalina or an Isodictya. The specimen under consideration was an old and fully matured one, and had probably ceased growing for a considerable time. In others very much shorter and more flexible, the growing portions from the paucity of the keratode surrounding the spicula so completely simulated the structure of an Isodictya, as to be very liable to mislead a young observer in his determination of the genus.

I have obtained numerous specimens of this species from the trawlers on the Diamond Ground, off Hastings, in the living state. In this condition the sponge is soft and fleshy to the touch, and has a considerable amount of green in its colour, and when dried in this state it becomes rigid, and of a dark dirty green colour. While living, the dermal

membrane appears to envelop the whole of the sponge; it is thin, translucent, and abundantly coated with sarcode, but rather sparingly furnished with tension spicula irregularly disposed on its surface. Beneath the dermal membrane the interstitial spaces are regularly furnished with membranes, coated with sarcode, and sparingly furnished with tension spicula, but the membranous tissues appear to fail at about one sixth of the diameter of the branch within the dermal membrane; below this part they only occasionally make an appearance, and are frequently entirely absent for a considerable space; but where they do thus appear in detached patches, they exhibit the usual amount of sarcode and spicula, and the reticulated structures are also abundantly coated with sarcode.

This species varies considerably in its structural development, in different localities. In exposed situations the fibre is generally stouter, but not more abundant in spicula than sponges from quiet and protected localities. In some specimens from the river Orwell, about four miles below Ipswich, the fibre was exceedingly delicate, or entirely obsolete, so that a section might have readily been mistaken for that of an *Isodictya*. Dr. Johnston, in his 'History of British Sponges,' page 170, and Montagu, in Wernerian Memoirs, vol. ii, p. 94, describes *Spongia levigata*; the latter author says: "This is the most delicate of all the soft British sponges; when compared with either *Oculata* or *Dichotoma*, their texture is extremely coarse." He also says: "The only piece of this sponge that has come under observation is tubular throughout, &c."

The specimen in Montagu's collection, now in the possession of Professor Grant, of University College, labelled *Spongia levigata*, in the same handwriting as the other specimen of that collection, consists of several small branches of the young of *Halichondria oculata* of Johnston. It agrees perfectly in the form and proportions of the spicula, and in the arrangement of the rest of the tissues, with well known specimens of the young of that species. The extreme variations that occur in *Hal. oculata*, both in form and degree of rigidity, renders the differential cha-

racters in the first paragraph from Montagu's description, quoted above, of very little value, and the figure and description of the form of the specimen in the second paragraph, is so opposed to that of the labelled specimen in Dr. Grant's possession, as to render it highly probable that it is not the type specimen described by Montagu. I fear, therefore, that the doubt appended to Dr. Johnston's description of "*Spongia? laevigata*," in his 'History of British Sponges,' must be considered as conclusive against its claim to be a *Spongia*, and especially so, as I have not yet met with a British sponge which would seem to favour such a conclusion.

## 2. CHALINA CERVICORNIS, *Bowerbank.*

*HALICHONDRIA CERVICORNIS*, *Johnston.*

**Sponge.** . Pedicelled, slender, branching dichotomously or trichotomously. Surface even, smooth. Oscula and pores inconspicuous. Dermal membrane unknown. Skeleton. Diffuse and somewhat irregular; primary lines cylindrical; radiating sinuously from the base to the apex of the sponge, sparingly spiculous, occasionally aspiculous; secondary lines irregular, rarely more than unispiculous; spicula acerate, rather short and stout, irregularly disposed. Interstitial membranes obsolete.

**Colour.**—In the dried state, dull green, verging to amber yellow.

**Habitat.**—Firth of Forth, *Johnston.*

**Examined.**—In the dried state.

I have seen no other specimens of this species than those preserved in the Johnstonian collection of sponges in the British Museum, labelled 47.9.7, 1447<sup>a</sup> and 7<sup>b</sup>, and both of them have been so well washed that none of the membranous tissues could be found remaining, so that the

specific characters given above are necessarily very imperfect; yet, a sufficient structural difference exists between them and the other British species of *Chalina* to render their identification by no means difficult. The only British species with which *C. cervicornis* is liable to be confounded is with slender specimens of *C. oculata*, and Dr. Johnston states, in page 97 of his 'History of British Sponges,' that "Dr. Fleming considers *Halichondria cervicornis* to be a variety of *H. oculata*, and I have seen specimens which favour this opinion, but in general their distinction is easy enough. The spicula are alike in both." With the first sentence in this quotation I perfectly agree, but not so with the second, as although the forms of the spicula in the two species compared are both acerate, their proportions are widely different; those of *C. oculata* being more than twice the length of those of *C. cervicornis*, in fact, as seventeen to seven; so that however similar worn specimens of either species may be to each other, the relative proportions of their spicula afford a ready means of discrimination. Dr. Johnston, in plate iv of his 'History of British Sponges,' has figured, apparently, a short and somewhat digitate specimen of *Chalina oculata*, "from a specimen in the collection of the late Mr. Templeton," as the magnified figure agrees with the structure of that species. Dr. Johnston also includes in his synonyms *Spongia ramosa* of Gerhard's Herbal, emended 1577, No. 9, and *Spongia stuposa*, Ellis and Solander's Zoophytes, 186, but both of these species undoubtedly belong to a different genus, and are described among our British species of *Dictyocylindrus*, as *D. ramosa* and *D. stuposa*. Montagu's *Spongia digitata* is also considered as a synonym of *Halichondria cervicornis* of Johnston, and this also is a misconception. I have had the advantage of examining Montagu's type specimen of his species, now in the possession of Professor Grant, of University College, and the result is, that it is not a sponge, but an Alga. The species must therefore be considered as those only which agree in their organisation with the types preserved in the British Museum, and represented in Plate v, figs. 1 and 2, in the 'History of British Sponges.'

### 3. CHALINA MONTAGUII, 'Bowerbank.'

**HALICHONDRIA MONTAGUII**, *Johnston.*

— **COLUMBAE**, *Johnston*.

**SPONGIA COLUMBAE**. Walker's Essays, p. 196.

— **CANCELLATA**, *Sowerby*, Brit. Miscel., 131, pl. lx; *Montagu*, in Wern. Mem., ii, 110; *Turton*, Brit. Faun., 208.

**SCYPHA CANCELLATA**. Gray's Brit. Plants, pl. i, 358.

**HALICHONDRIA COLUMBAE**. Fleming's British Animals, 521.

**Sponge.** Sessile, irregularly latticed by cylindrical inosculating tubular branches. Surface smooth. Oscula simple, slightly elevated, dispersed, or terminal. Pores inconspicuous. Dermis reticulated, rete uniserial; dermal membrane aspiculous, pellucid, and thin. Skeleton. Primary lines more or less multispiculous; secondary lines rarely more than unispiculous; fibre variable in diameter; spicula acerate, short and stout. Interstitial membranes spiculous; tension spicula acerate, slender.

**Colour.**—Light brown, occasionally pink.

**Habitat.**—Devonshire coast, Montagu; Connemara, McColla; Brighton, Mr. Thomas Ingall; Hastings, J. S. Bowerbank.

**Examined.**—In the dried state.

Dr. Johnston's description and figure of *Halichondria Montaguii* differs considerably from those which have fallen under my own observation; so much so as to create some doubt whether the sponge he described is identical with the one to which I have allocated that name; and yet there is so much agreement in the tubular and other parts of the sponge I am describing in its general structure, and no other species known to me which appears to compete with it in right to the name of *Montaguii*, that I am led to believe that the species in hand is truly the one to which Dr. Fleming applied the name of *Montagu*. The spicula figured by Dr. Johnston as those of the sponge he describes are certainly very much larger in proportion than those of

the sponge to which I have allocated the name of Montagu. It is quite possible that the differences in form between the two may arise from the differences in their localities, and in the form and modes of ramification of the Fuci or Zoophytes on which they are usually parasitical.

My late friend Mr. Thomas Ingall obtained a great number of specimens of this sponge, which were collected at Brighton, and which are now in my possession, and among them there is a very great variety in both size and form. In some the inosculating latticed form is very irregular and open, the cylindrical branches not exceeding two or three lines in diameter, and the whole sponge has a fragile and delicate appearance ; while in others, the branches coalescing by juxtaposition, or increasing in diameter by age, assume a compressed or very irregularly cylindrical form, and attain a diameter of nearly or quite half an inch, and the intervening spaces becoming less in width. In this condition the sponge very closely resembles the large and complex specimens of *Isodictya simulans* when dried, but from which they may be readily discriminated by their softness and elasticity.

The irregular latticed and inosculating character of this sponge is greatly dependent for its form to the Fucus or Zoophyte on which it is parasitical. It appears to completely envelop and follow the direction of the body on which it is developed, and the branches appear to inosculate whenever they happen to touch each other ; and it is only when they outgrow the base on which they were first formed, that they continue their course as cylindrical branches independent of extraneous support ; and they then frequently have a wide terminal oscular orifice.

The tubes generally extend through the whole length of the branches, but not with an equable diameter, and their parietes have no oscular membranes ; they do not, therefore, appear to be regular cloacal fistulae, but rather to exhibit a greater proportional development of the system of excurrent canals than is usual in ramosc sponges ; the oscula are frequently small and simple, and are found dispersed on all parts of the branches ; at other times they are large and

considerably elevated, or they are large and terminal orifices at the distal parts of the sponge.

The dermal reticulation is very irregular, but it appears to be always unispiculous, and the sides are composed each of a single spiculum. Each area contains two or three minute pores. The dermal spicula are of the same form as those of the skeleton, but a little less stout.

The skeleton is very unequal in the extent of its development at different parts of the sponge; in the older portions the fibres are well produced, and the primary ones multispiculous, while in the younger parts the general aspect of the skeleton is very much like that of an *Isodictya*, and the primary fibres are scarcely distinguishable in their structures from the secondary ones.

The spicula are regularly acerate, and are short and stout; one of the largest measured  $\frac{1}{250}$ th inch in length, and  $\frac{1}{500}$ th inch in diameter.

The interstitial membranes do not appear to exist to an equal extent in all parts of the sponges, but to occur irregularly in detached patches; some of these spots are abundantly furnished with tension spicula of about the same length as those of the skeleton, but much more slender; in other parts there are very few of them present.

Dr. Johnston, in his 'History of British Sponges,' page 101, describes, without figuring, *Halichondria Columbae* in the following terms:—"Irregularly latticed by rounded inosculating branches; spicula double pointed and curved." This meager description will apply equally well to *Chalina Montaguii* and *Flemingii*, and to *Isodictya simulans* in its fullest state of development, and I feel strongly persuaded to conclude that the sponges described by Dr. Walker in his essays, page 196, as *Spongia Columbae*, and that by Sowerby, 'British Miscellany,' page 131, and plate 60, as *Spongia cancellata*, are, in fact, but specimens of *Chalina Montaguii*; and I am led to this conclusion by the fact that among the very large number of specimens of *Chalina Montaguii* examined, I have been quite unable to find any one that possessed such organic distinctive characters as would entitle it to be considered as at all likely to be a

satisfactory representative of either Walker's or Sowerby's species. On the contrary, Walker's description of his sponge, quoted by Dr. Johnston at full length, is applicable in every point to the ordinary specimens of *Chalina Montaguii*. Dr. Fleming was of opinion that the sponges described by Walker and Sowerby were identical, and in this opinion I perfectly concur; and, moreover, that learned naturalist states, "This remarkable sponge was brought me fresh from Brighton by Mr. Fellows, September 17th, 1805. Its cancellated structure distinguishes it at first sight from all others that I have seen, either specimens or figures of, especially as British." The locality of Mr. Fellows' specimen being that also which produces *Chalina Montaguii* in such profusion, appears to me to lead irresistibly to the idea that they are but the same species. I have therefore thought it better to consider Dr. Johnston's *Halichondria Columbae* as only a synonym of *Chalina Montaguii*, and especially so as Sowerby's figure of it in the 'British Miscellany' renders us no assistance in distinguishing the species, and is in truth an excellent representation of a very common form of *Chalina Montaguii*, as found at Brighton.

Dr. Johnston has quoted the whole of the printed observations on their respective sponges by Sowerby and Walker, excepting the specific character of the latter, which is as follows:

"*Spongia Columbae*, sessilis rarissima pellucida septimentosa, septimentis planis inosculatis; supra foraminibus rotundus." Presuming the three specific names "Cancel-lata," published by Sowerby in 1806; "Columbae," published by Walker in 1812; and "Montaguii," by Fleming in his 'History of British Animals,' in 1829, Sowerby's specific name should perhaps take precedence; but the latter of the three names having been so long and so well established in the works of Fleming and Johnston, I have thought it advisable to adhere to that adopted by the authors last named.

**4. CHALINA FLEMINGII, *Bowerbank.***

Sponge. Sessile, irregularly latticed by cylindrical inosculating tubular branches. Surface smooth. Oscula slightly elevated or terminal, large. Pores inconspicuous. Dermis furnished with a stout kerato-fibrous reticulation, with a uniserial line of acerate spicula more or less variable in size. Dermal membrane pellucid, thin, sparingly spiculous; spicula same as those of the dermal reticulation and of the skeleton. Skeleton rather open and diffuse; fibres stout, primary and secondary lines, spicula uniserial; interstitial spaces frequently the width of the length of two or three spicula. Spicula acerate very slender. Interstitial membranes nearly obsolete, rarely spiculous; tension spicula few in number, same as those of the skeleton.

*Colour.*—Dried, light brown.

*Habitat.*—Brighton, Mr. Thomas Ingall.

*Examined.*—In the dried state.

I have seen but one specimen of this species, it was given to me by my late friend Mr. Thos. Ingall, among a number of specimens of *C. Montaguui*, which it very closely resembles in form and general appearance. It is softer and more flexible to the touch, and the branches are more decidedly tubular than those of that species. In size it does not extend more than an inch and a half in any direction, and it is parasitical on a small *Fucus*, in company with two small specimens of *Halichondria panicea*.

The kerato-reticular dermal network is stout and well produced; the spicula are of the same proportions as those of the skeleton, acerate, and very slender. A very few fragments of the dermal membrane remained *in situ*, and in these a few spicula of the same form and propor-

tions as those of the dermal membrane were observed. Occasionally, for a very small space, the spicula within the dermal fibre were slightly increased in length, and their diameters became double those of the neighbouring ones of the normal form ; and the transition from the one form to the other was not gradational, but the spiculum next to one of the stout ones was completely in unison with the proportions of those of the general mass of the rest of the dermal reticulations, and of the skeleton ; this singular variation in their proportions did not appear to exist to any great extent, as, on dissolving separate portions of the sponge in nitric acid, but very few of the larger forms were to be seen, in comparison with the number of those of the normal one. In one of the pieces thus dissolved very few extraneous forms of spicula appeared, while in another piece, treated in a similar manner, numerous extraneous forms made their appearance ; these were apparently due to their adhesion to the dermal portions of the part of the sponge thus treated, as I could not detect such extraneous forms within sections of the sponge, nor on slices taken from the surface of it. The diameters of the keratose fibres of the skeleton are nearly equable throughout its structure, and they appear greatly to exceed the proportions necessary to the envelopment of the single series of very slender spicula that forms its axis. I found but a very faint trace of the interstitial membranes, but the little there was had a few tension spicula upon its surface in some of the areas.

The length of a full-sized spiculum of the normal form is  $\frac{1}{300}$ th inch, and the diameter  $\frac{1}{750}$ th inch.

I have dedicated this species to the memory of the late Dr. Fleming, as a small token of respect, and in acknowledgment of the valuable services he has rendered to zoological science.

**5. CHALINA GRACILENTA, Bowerbank.**

Sponge. Coating, parasitical. Surface even when young, nodulated when old, asperated. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane pellucid, aspiculous, or with a few tension spicula only. Skeleton. Spicula fusiformi-acerate, minute, abundant in all parts of the fibre. Tension spicula same as those of the skeleton, few in number.

*Colour*.—Alive, yellow; when dried, light brown.

*Habitat*.—Torbay, Mrs. Griffiths; Scarborough, Mr. Bean; coast of Northumberland, Rev. A. M. Norman; Hastings, J. S. Bowerbank.

*Examined*.—In the living and dried states.

I received two specimens of this sponge from Mrs. Griffiths, who found them enveloping the stems of *Codium tomentosum*; neither of them were an inch in length, and in the dried condition did not exceed half a line in thickness. The skeleton is slender, and the general aspect of the sponge is very light and delicate; with a two inch lens the surface is seen to be asperated by the projection of the surface fibres. On examining a thin slice immersed in water, with a power of 260 linear, the membranous structure presented a comparatively thick and granulous appearance, and but very few spicula could be detected within its substance, but on subsequently mounting the same fragment in Canada balsam, the spicula both in the fibres and the membranes became much more distinctly apparent. There is no distinction visible between the spicula of the two organs, but they are so minute as to render it necessary to use a power of about 400 linear to define their form decisively.

I also received two specimens from the Rev. A. M. Norman. One of them was very thin, not exceeding half a

line in thickness ; the surface was even, but no oscula were visible. The other was about three quarters of an inch long, and nearly the same in breadth. The surface was uneven, rising in irregular ridges or tubercular masses to about the height of two lines from the base. There were four oscula on the most elevated parts of the sponge ; they were from half to three fourths of a line in diameter. Some of the large areas of the dermal membrane were aspiculous ; in others, there were a few scattered tension spicula. The thickest of the two specimens was much more rigid in its structure than those previously described.

In a small specimen in the living condition, which I subsequently obtained at Hastings, the fibres were, some of them, thickly coated with sarcode, and others entirely enveloped in it, so that the interstices of the skeleton were completely filled with it. An abundance of nutrient molecules were attached to the surface of the sarcode, and others were apparently buried beneath the surface. The colour of the sarcode was precisely the same as that of the skeleton fibres.

## 6. CHALINA LIMBATA, *Bowerbank.*

**SPONGIA LIMBATA,** *Montagu.*  
— — — *Johnston.*

Sponge. Massive, sessile, subglobular, lobed, or coating. Surface hispid. Oscula simple, large, few in number. Pores inconspicuous. Dermis irregularly and diffusely fibro-reticulate ; fibres multispiculous ; spicula, fusiform-acerate, slender ; dermal membrane pellucid, abundantly spiculous ; spicula same as those of the fibre. Skeleton, compact and regular ; primary and secondary lines multispiculous, spicula, fusiform-acerate, slender. Interstitial membranes, nearly obsolete, abundantly spiculous ; spicula same as those of the skeleton.

*Colour.*—Dried, dull green, yellow, or brown.

*Habitat.*—Eastern and western coasts of England and Scotland; coasts of Ireland; usually parasitical on Fuci.

*Examined.*—In the dried state.

This sponge is by no means a rare species. It is usually parasitical on Fuci, and seldom exceeds a hazel-nut in size. When small it has frequently but one osculum, but when of larger size it has two or three, but rarely more. The surface is hispid, by the projection of the distal terminations of the primary lines of the skeleton. The dermal membrane is smooth and pellucid, in some parts it appears to be aspiculous, while in others the tension spicula are abundant. The areas of the dermal reticulation are very much larger than those of the skeleton structure.

The skeleton fibres are cylindrical, and rather stout; they are abundantly supplied with spicula, which are dispersed excentrically, mostly in lines agreeing with the axis of the fibre, but occasionally they cross ~~each~~ other at right angles where a branch is given off. The primary lines of the skeleton radiate from the base or centre of the sponge. The secondary ones are at about right angles to the primary ones, but they are frequently very irregular. The disposition of the spicula in the fibre is very remarkable in this sponge; there is no approach to the axial arrangement so distinctly exhibited in the fibres of other species of this genus, but they appear to be disposed in all parts of the fibre, so as to simulate the structure of a *Desmacidon*, but with this distinction, that whether few or many they are always the subordinate material in the construction of the fibre, and never appear to influence its form and proportions as in a *Desmacidon*, and in the young and slender, but perfectly formed fibres there are frequently no spicula present.

A small encrusting specimen of this sponge was sent me by Mr. Alder, who found it at Cullercoats. It had the dermal and other membranes in good condition; immersed in water, a small portion exhibited an appearance of spicula imbedded in the sarcode with which the membranes were

covered. On mounting the same piece of the sponge in Canada balsam, numerous spicula were apparent, dispersed on the membrane, singly or in loose fasciculi ; they were of the same form, slender acerate, as those imbedded in the horny fibre ; the sarcode was rather abundant, and of a dark amber colour.

Dr. Johnston, in his 'History of British Sponges,' has expressed an opinion that this species and *Spongia lobata* of Montagu are the same ; but this is not the case. The type specimen of *S. lobata*, Montagu, in the possession of Professor Grant, is an Isodictya, and has acuate spicula, while *Chalina limbata* has acerate spicula. Had Dr. Johnston had the advantage of seeing the type specimen of *S. lobata*, he would not, I am certain, have entertained such an opinion.,

### 7. CHALINA GRANTII, Bowerbank.

**Sponge.** Sessile, branching and inosculating, fan-shaped ; branches somewhat compressed. Surface even, minutely hispid. Oscula simple, dispersed. Pores inconspicuous. Dermal membrane aspiculous. Skeleton. Branches non-fistulous ; primary lines bi or trispiculous ; secondary lines unispiculous ; spicula acerate, stout, rather short. Interstitial membranes aspiculous.

**Colour.**—Dried, light gray.

**Habitat.**—Brighton, Mr. Thos. Ingall.

**Examined.**—In the dried state.

I received a single specimen of this species, with other British sponges, obtained by my late friend Mr. Thos. Ingall, at Brighton. The specimen, from its condition, has every appearance of having been partially water-worn and cast up on the beach. The dermal membrane on some parts of it was in a tolerably perfect state of preservation ; it is situated at about the depth of the length of one

spiculum beneath the distal points of the hispidating fasciculi of spicula, which are the distal terminations of the primary lines of the skeleton. There were no indications of a dermal reticulation, nor could I detect a single tension spiculum in any part of the dermal membrane that I examined. The texture of the skeleton is close and compact, and the primary lines are separated by rarely more than the length of a single spiculum; the fibre is well produced, and amply covered with keratode. The interstitial membranes do not appear to prevail in all parts of the interior of the sponge, but the detached patches of it observed were well covered with a dark amber-coloured sarcode, in which no tension spicula could be detected, nor could any such be found among the spicula obtained by the dissolution of a portion of the sponge by boiling in nitric acid.

The spicula of this species are rather long, and of greater diameter than those of *C. Montagu*ii; a large-sized one measured  $\frac{1}{215}$ th inch in length, and  $\frac{1}{272}$ th inch in diameter.

I have dedicated this species to my friend Dr. Grant, as a slight acknowledgment of the valuable services he has rendered to science by his lucid demonstrations of the anatomy, physiology, and natural habits of the British species of sponges.

## 8. CHALINA SERIATA, Bowerbank.

*HALICHONDRIA SERIATA*, Johnston.  
*SPONGIA SERIATA*, Grant.

**Sponge.** Sessile, coating; surface even, more or less minutely hispid, by the fasciculi of the distal terminations of the primary lines, and by the projection of single spicula at right angles from the secondary lines, at the surface of the skeleton. Oscula simple, numerous, nearly equidistant. Pores inconspicuous. Dermal membrane, sparingly spiculous; spicula slender, sub-fusiform acuate; and slender tricurvate acerate. Skeleton. Primary fibres stout, abundantly armed;

defensive spicula, same as those of the skeleton ; projected upward at angles from 12 to 45 degrees to the axes of the primary fibres ; secondary fibres not containing spicula ; defensive spicula usually single, projected upward at about right angles to the fibres on which they are based. Spicula fusiformi-acuate, short and stout. Interstitial membranes spiculous ; spicula slender, sub-fusiformi-acuate and tricurvate acerate, very slender.

*Colour.*—Alive, dark blood-red.

*Habitat.*—“ Frith of Forth, Dr. Grant ; Island of Ireland’s Eye, off the Dublin Coast, Wm. Thompson, Esq.” St. Katherine’s Rock, Tenby, J. S. Bowerbank ; Bantry Bay, Falmouth, and Jersey, Rev. A. M. Norman.

*Examined.*—In the living state.

This species does not appear to attain a considerable size. I have never seen specimens exceeding three inches in diameter, and half an inch in thickness, and it is frequently found not more than two or three lines in thickness, smoothly and evenly coating the rock on which it is based. In the living condition the hispidation is rarely to be detected without the dermal membranes, the terminal fasciculi of the primary radiating lines of the skeleton having their apices immediately beneath the membrane, but in other cases they distinctly penetrate and pass through that organ. The oscula are very characteristic of the species, and there is a considerable amount of uniformity in their diameters, and in the mode of their disposition. The tricurvate tension spicula of the dermal and interstitial membranes are rather unusual in their form, the central curve is greatly produced, while the terminal curves are sometimes scarcely apparent. These spicula are rather numerous and variable in size. The structure of the skeleton is very remarkable. The primary lines of fibre are composed of stout fusiformi-acuate spicula and keratode irregularly cemented together, and from the sides of this fibre numerous spicula similar in form and size to the im-

bedded ones are projected at various angles, in an upward direction, thus assuming the office of internal defensive spicula. The secondary fibres of the skeleton are usually aspiculiferous, solid, and cylindrical, and from about the middle of the greater portion of them there is a single auxiliary defensive spiculum, projected in an outward direction; the spicula have their bases firmly imbedded in the keratose fibre, from which they emanate. The internal defensive spicula are not equally abundant in every specimen of the species. In one from the coast of Cornwall, which completely enveloped the stem of a large *Fucus* nearly an inch in diameter, for about three inches of its length, they were remarkably few in number, many of the primary lines being destitute of them; the thickness of the sponge did not exceed the eighth of an inch. The interstitial membranes do not appear to exist in an equal degree in all parts of the interior of the sponge, but when present, they are rather abundantly furnished with the two forms of tension spicula described above.

### OPHLITASPONGIA, *Bowerbank.*

#### 1. OPHLITASPONGIA PAPILLA, *Bowerbank.*

Sponge. Sessile, massive; surface papillated, hispid. Oscula simple, on the apices of the papillæ. Pores inconspicuous. Dermal membrane pellucid, spiculous, spicula fusiformi-attenuato-acuate, rather slender; and tricurvate acerate, variable in size, numerous. Skeleton. Fibre stout and strong; rete compact; somewhat irregular; spicula fusiformi-attenuato-acuate, short and stout, numerous, projected from the surfaces of the fibres at various angles to their axes. Interstitial membranes spiculous; spicula same as those of the dermal membrane.

*Colour.*—Dried, light brown.

*Habitat.*—Vazon Bay, Guernsey, Mr. Cooper.

*Examined.*—In the dried state.

I received this sponge from the Rev. A. M. Norman, who obtained it from Mr. Cooper, of Guernsey. It is nearly triangular in form, the longest side being an inch and a quarter in length, and its greatest height is half an inch. Within the space of the triangle there are eighteen small, roundly terminated papillæ crowded together, each having an osculum at its sunmit. The largest is half an inch in height, and the diameter near the base is three lines; the smallest papilla is not more than two lines in height. In a second small portion of the specimen, which accompanied the larger, one, about the eighth of an inch in thickness, there are three oscula, which are but very slightly elevated above the level of the surface; from which we may infer that it is only in the adult specimens that we may expect to find the full development of the papillæ. The hispidation is produced by the terminations of the primary skeleton fibres, the apical spicula of which diverge at various angles, forming a very efficient series of defences to the surface of the sponge. In each of the papilla there appears to be a single central cloacal canal, nearly equal to its own length, terminating at the apex of the papilla in a simple osculum.

In those parts of the dermal membrane which were in a good state of preservation, the tension spicula were rather abundant; the acuate ones are of the same form as those of the skeleton, but more slender. The tricuspidate spicula vary considerably, both in length and diameter, and in some the central curve is but slightly produced, and the terminal ones are nearly obsolete. On the primary fibres of the skeleton the spicula are given off at a very slight angle to its axis, varying from a few degrees to twelve or about sixteen, but on the secondary fibres they are projected at nearly right angles to its axis, and in the former they are very numerous, while in the latter they are comparatively few in number. The interstitial membranes are

not equally prevalent in all parts of the sponge, but where they do occur they appear to abound in tension spicula of both forms, to quite as great an extent as in the dermal membrane. In a letter from Mr. Cooper to the Rev. A. M. Norman, the former gentleman writes, in answer to inquiries regarding the locality of *O. papilla*,—"I have no hesitation in saying, that I found the specimen at Vazon Bay, after one of the storms which visited this island in the month of February last (1865). The sponge was unattached, and associated with other specimens veritably British, in the debris on the shore. As I have not seen another example, I am sorry to confess I can afford no further account of the specimen. I do not possess any foreign sponges."

### VERONGIA, ~~Bowerbank.~~

#### 1. VERONGIA ZETLANDICA, *Bowerbank.*

Sponge. Massive, sessile, rising in one or more lobular masses. Surface even, minutely hispid. Oscula simple, dispersed, most frequently terminal. Pores inconspicuous. Dermal membrane pellucid. Skeleton. Fibres stout; canals irregular and often abnormal at the junctions of the secondary with the primary fibres.

*Colour*.—Dried, light brown.

*Habitat*.—Shetland, Mr. Barlee and Rev. A. M. Norman.

*Examined*.—In the dried state.

My first knowledge of this species was from a small and very imperfect specimen dredged at Shetland, by my late friend Mr. Barlee. I received subsequently eight speci-

mens for examination, from my friend the Rev. A. M. Norman, who also dredged them at Shetland, in 1861.

They vary in height from four lines to one inch. Seven of them are in the form of a single irregularly shaped lobe, gradually expanding in size upward to the distal termination. The eighth specimen is fan-shaped, having the appearance of three such lobes, which have coalesced by approximation. There is a strong general tendency to a conjugation of the oscula at the distal end of the sponge, in the same manner that we observe in specimens of the best Turkey sponges of commerce before they commence expanding into the cup form. The oscula are distinctly apparent, frequently exceeding half a line in diameter. The central canals of the primary fibres are comparatively large, and appear to be continuous, but they are very variable in their diameter within comparatively a short distance, and a considerable amount of irregularity exists at the points of junction of those of the secondary fibres with the primary ones. Instead of running directly into those of the primary fibres, they frequently divide when they reach it, and run in contrary directions before entering and uniting with it, and sometimes they end in cæcoid terminations without entering the primary canal at all.

### DYSIDEA, *Johnston.*

#### IDEA FRAGILIS, *Johnston.*

#### HALICHONDRIA AREOLATA, *Johnston.*

Sponge. Massive, sessile, variable in form, rarely coating. Surface asperated. Oscula and pores inconspicuous. Dermal membrane nearly obsolete, aspiculous. Skeleton; rudely symmetrical; primary fibres radiating from the base; secondary fibres more or less irregular, primary and secondary fibres more or less abundantly

arenaceous, occasionally in some parts destitute of sand; sometimes tubular, or furnished with adventitious spicula of various forms, imbedded in the fibre, or attached externally. Interstitial membranes aspiculous. Gemmules membranous, aspiculous.

*Colour.*—Alive and dried, variable, but usually dull ochreous-yellow.

*Habitat.*—Coasts of Great Britain, abundantly.

*Examined.*—Alive and in the dried state.

In the young state this species is occasionally found thinly coating the surface of stones; in this condition it has been described by Dr. Johnston as *Halichondria areolata*, 'History of British Sponges,' p. 121. But its usual form is more or less massive, sometimes it is developed in numerous short, thick, fan-like ridges, or it projects short lobular branches from its surface, in an upward direction; the latter form usually occurs when it attains the height of four or five inches, and which height it very rarely exceeds. The asperation of the surface is produced by the projection of the distal ends of the primary lines of the skeleton fibre. The structure of the skeleton is so coarsely reticulated that it is frequently very difficult to determine the position of the oscula; occasionally there are a few large excurrent canals visible, which have their oscular terminations projected beyond the surface of the sponge. A few patches of dermal membrane are sometimes to be found on the surface, but in no case have I yet succeeded in finding the pores. A few adventitious spicula may occasionally be found on the dermal membrane, but it is usually free from either particles of sand or spicula. The mode of construction of the arenaceous fibres of the skeleton is very remarkable and exceedingly interesting, but as I have described these structures in detail, in Vol. I., p. 78, of this work, it is unnecessary to enter further into the details of their structure. The degree of the arenation of the skeleton fibres is remarkably variable. In some cases the sponge appears to consist of a mass of particles of sand, loosely cemented

together; in others, the fibres, although thickly covered with patches of sand, are still separate and distinct; in other specimens the fibres are cylindrical and symmetrical, with included grains, but with few external ones; and the last two modes may be frequently observed to occur on the opposite side of the same specimen, so that the amount of the arenation of the fibre is evidently dependent on the peculiarities of its locality, and the paucity or abundance of sand or other extraneous matters suited to its purpose, that is found in its neighbourhood. Thus, in the specimens found on the shore at Brighton, where little sand comparatively is found, the adventitious substance incorporated on the skeleton abounds with various forms of sponge spicula, while those from the neighbourhood of the sands of Hastings are filled with sandy particles, and but rarely exhibit specimens of spicula; and I am therefore led to believe that the latter, when they do occur in the sponge, are truly adventitious and not secreted by the animal under any circumstances. In the living state the sarcode is very abundant, filling up nearly the whole of the interstitial spaces, and causing the sponge to have a firm and fleshy texture.

In some living specimens obtained at Brighton, I observed, besides the arenaceous and solid keratose fibres, that there were occasionally others that were fistulous, sometimes containing a few grains of sand and spicula, more or less numerous. The tubular fibres are smaller than the arenaceous ones; they originate from them, and anastomose freely with them; the fistulous cavity is very irregular in its size, sometimes being large and continuous, or suddenly contracting and becoming small in diameter. These fibres appear to be destined to fill an important office in the economy of the animal—for in many of the Brighton specimens I observed gemmules of various sizes imbedded in the parietes of the tubes, some of them projecting from the inner surface towards the centre of the fistulous cavity; but the greater number were projected from the outer surface of the fibre in all degrees short of absolute separation. When viewed with a power of 300 linear, they are seen to have a large opaque nucleus, of a somewhat

granular character, which fills the whole of the thin horny-looking shell or coat. The interstitial membranes are thickly covered by sarcodæ, of a firm consistence, in which there are often imbedded an abundance of nucleated cells, varying in diameter from  $\frac{1}{6000}$ th to  $\frac{1}{4000}$ th of an inch. Among the numerous specimens of this sponge that have passed through my hands, I have been unable to detect more than one species; although presenting every imaginable variety in form, size, and colour, there were no permanent characters indicating an organic specific difference.

Dr. Johnston, in his 'History of British Sponges,' page 190, describes, and in page 191 and plate xvi, figs. 6 and 7, figures, a second species of *Dysidea*, *D. papillosa*; but he expresses his doubts of its being truly a sponge, and his belief that it was "the nidus of some invertebrated animal, probably of a species of *Natica*." Since that period specimens of the presumed *D. papillosa* have been found containing the living animals, by the late Mr. Barlee, at Shetland, and by Mr. Holdsworth, near Torquay, which have been determined by Mr. Alder and Mr. Gosse to belong to the Zoanthidæ, and Mr. Gosse has described them in his 'Actinologia Britannica,' page 297, plate ix, figs. 9, 10; and plate x, fig. 5, as *Zoanthus Couchii*.

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